AVIATION WEEK

A McGRAW-HILL PUBLICATION

December 9, 1957 75 cents

Sabreliner Fits USAF Shelf Item Trainer Concept

North American F-107A

Test Facilities for Thor, Atlas, Titan

1951—First lightweight all-metal anchor nut

1952—First narrow lightweight gang channel

1953—First narrow lightweight floating anchor nut

1954—First miniature anchor nut

1955—First miniature floating anchor nut

1956—First deep counterbore floating anchor nut

"The Most Copied Nut In The World"

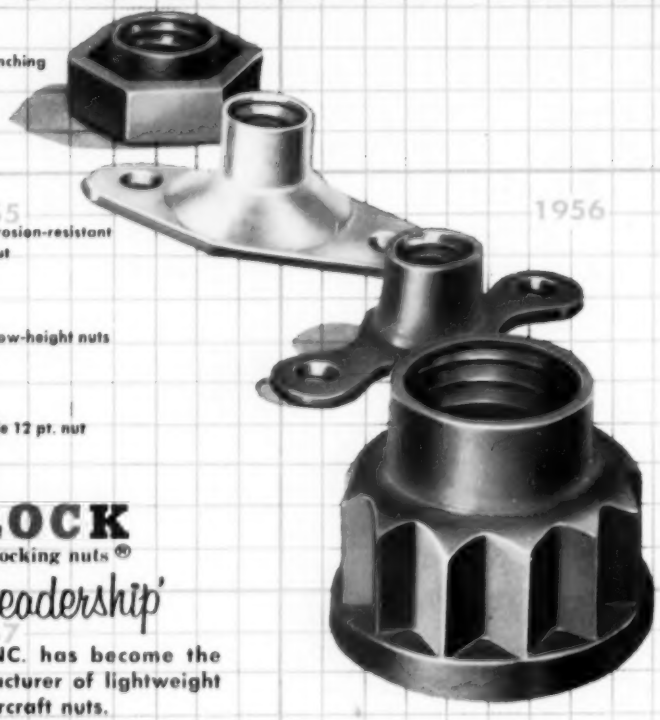
SETTING STANDARDS OF PROGRESS

1956—First internal/external wrenching hex nut

1956—First lightweight A-286 corrosion-resistant steel anchor nut and hex nut

1957—First complete line of NAS low-height nuts with thread relief

1957—First lightweight high tensile 12 pt. nut



KAYLOCK

All-metal self-locking nuts ®

'symbol of leadership'

KAYNAR MFG. CO. INC. has become the world's leading manufacturer of lightweight all metal self-locking aircraft nuts.

- *All metal, rugged one piece construction*
- *Highest strength, lightest weight, lowest height*
- *Uniform locking torque* • *"Infinite" re-usability*

Kaylock Nuts conform to all Air Force-Navy standards: AN363, AN364, AN365, AN366, and the new low height lightweight National Aircraft Standards.

Kaylock Nuts available in steel or A-286 corrosion-resistant steel for use to 1200°F.

KAYNAR MFG. CO. INC., KAYLOCK DIVISION Dept. A5-
Box 2001 Terminal Annex, Los Angeles 54, California
Canadian Distributor: Abercorn Aero Ltd., Montreal, Quebec

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TWICE THE HUSTLE

with HALF THE MUSCLE!

Today, thanks to *a complete ground support system* conceived, designed and engineered by Goodyear Aircraft Corporation, missile squadrons have more "hustle" – require but a fraction of the "muscle" previously expended to transport, set up and go into action.

- The number of vehicles required has been drastically reduced.
- Only one engine type – already in world-wide Air Force inventory – is employed. It provides the power needs for vehicles as well as electronics and maintenance equipment.
- Now only one type prime mover of "universal design" is required. It can execute any movement required within the squadron, carry any one of the specially Goodyear-engineered "packs" of ground-handling equipment, and haul the launchers which were also built by Goodyear Aircraft.
- Each pack can be "telescoped" for clearance. As a result, trucks and entire system are air-transportable – easily moved to strategic areas in a hurry.
- Once there, the squadron can traverse terrain heretofore impassable – even through swampy areas, change location in a matter of hours – thanks to the huge, low-pressure "Go-Anywhere" Terra-Tire developed by Goodyear.

This astonishing mobility, adaptability and practical logistics owes its success to a new design concept—engineered and executed to the smallest detail by Goodyear Aircraft.

They're doing big things at

GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Litchfield Park, Arizona
Rewarding Challenges and Careers for Engineers

Terra-Tire—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

THE MARK OF QUALITY

BARBER COLMAN

Aircraft Controls

BARBER-COLMAN TEMPERATURE CONTROL SYSTEMS

A proportioning polarized relay control system is applied to the B-58. The complete line of Barber-Colman temperature controls for aircraft includes: Cycling, proportioning, floating, electronic, transistor, magnetic amplifier, polarized relay.

CONTROL BOX

VALVE

SENSING UNIT

Barber-Colman temperature controls selected for B-58 detachable pod

America's first supersonic bomber, the USAF B-58 "Hustler" built by Convair, is designed specifically to carry a detachable "pod" under its fuselage. With these capsules, this versatile plane is capable of performing a wide variety of missions. To maintain a constant temperature in a pod flight test equipment compartment, Convair has chosen a Barber-Colman temperature control system. Other Barber-Colman equipment is furnished to contractors of the B-58 air conditioning system. For help on your control projects, consult the Barber-Colman engineering sales office nearest you: Los Angeles, Seattle, New York, Fort Worth, Baltimore, Montreal.

CAREER OPPORTUNITIES: Excellent openings for qualified engineers

BARBER-COLMAN COMPANY

Dept. X, 1422 Rock Street, Rockford, Illinois

Aircraft Controls • Electrical Components • Automatic Controls • Industrial Instruments • Air Distribution Products
Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

AVIATION CALENDAR

Dec. 9-13—1957 Eastern Joint Computer Conference and Exhibit, Sheraton Park Hotel, Washington, D. C.

Dec. 11—R&D Aspects of Army Air Mobility, speaker: Brig. Gen. Frank H. Britton, Director of Development, Office of Chief of R&D, Dept. of Army, sponsored by American Helicopter Society, 6:30 p.m., Skyview Restaurant, Philadelphia International Airport.

Dec. 16-17—Missouri Conference on Utilization of Engineers and Scientists, University of Missouri Campus, Columbia, Mo.

Dec. 16-18—Air Traffic Control Symposium, "The Mission and Methods of the Airways Modernization Board," sponsored by Franklin Institute, Sheraton Hotel, Philadelphia, Pa.

Dec. 17—21st Wright Brothers Lecture—Hypersonic Flight and the Re-Entry Problem, H. Julian Allen, NACA, Natural History Building Auditorium, Smithsonian Institution, Washington, D. C.

Dec. 18—Gas Turbine Development, speaker: Rear Adm. S. B. Spangler, USN, Air Development & Material Center, at Engineers Club, Philadelphia, Pa.

Jan. 6-8—Fourth National Symposium, Electronics Reliability and Quality Control, Hotel Statler, Washington, D. C.

Jan. 13-17—1958 Annual Meeting, Society of Automotive Engineers, Sheraton-Cadillac and Hotel Statler, Detroit, Mich.

Jan. 13-May 14—Lecture series on Space Technology, sponsored by University of California and Ramo-Wooldridge Corp., to be held in Los Angeles, San Diego and San Francisco. For details write: University of California Extension, Dept. of Conferences and Special Activities, Los Angeles 24, Calif.

Jan. 14-15—Yankee Instrument Fair & Symposium, sponsored by Instrument Society of America (Boston, Connecticut Valley and Fairfield County Sections), Hotel Bradford, Boston, Mass.

(Continued on page 6)

AVIATION WEEK • DECEMBER 9, 1957

Vol. 67, No. 23

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TITANIUM® RIVETS

A REMARKABLE SAVING IN WEIGHT WITH NO LOSS IN STRENGTH

Boeing's B-52 Intercontinental Jet Bomber of the USAF's Strategic Air Command gives this nation a retaliatory weapon capable of carrying out nuclear strikes anywhere in the world. Speeds beyond 650 mph, altitudes in excess of 50,000 feet and an unlimited range with refueling, make the B-52 one of the most powerful weapons in recorded history.

Titanium Hi-Shear Rivets are being used extensively in the B-52 and have trimmed hundreds of pounds from the total weight of the airplane. Weight savings of this nature mean longer range, greater speed and better overall airplane performance.

Hi-Shear Rivet Tool Company is now producing Titanium Rivets in large production quantities and a full range of sizes. A comprehensive test program has indicated the fine physical characteristics of this fastener, insuring the continued high precision quality of the Hi-Shear Rivet in this new material.

Write in for details and information on this and other Hi-Shear fasteners.

LEFT — Countersunk head Titanium Hi-Shear Rivet used to fasten skin panels.

LOWER LEFT — Protruding head Titanium Hi-Shear Rivet used to fasten a fitting and flat panel.

LOWER RIGHT — Titanium Hi-Shear Dowel Pins used to fasten two sloped surfaces, eliminating spot facing . . . used on a tubular assembly, conforming to a round surface.

hi-shear RIVET TOOL COMPANY

2600 WEST 247TH STREET • TORRANCE, CALIFORNIA

HERE IS THE REMARKABLE

ROTARY ACTUATOR

DESIGNED BY CLEMCO

AERO PRODUCTS, INC.

opening up new horizons in the field of aircraft and guided missiles for the world today...for the universe tomorrow

NOW, CLEMCO ANNOUNCES NEW FEATURES WHICH COMPLETELY REVOLUTIONIZE ROTARY ACTUATOR PERFORMANCE!

New CLEMCO developments in seals have now, for the first time, overcome the leakage, friction, and lost motion barriers.

For the first time CLEMCO has developed stress and deflection analyses which result in rotary actuators of minimum weight, with complete assurance of structural integrity.

NOW, THE THEORETICAL ADVANTAGES OF ROTARY ACTUATORS BECOME A REALITY!

Here's the proof! Internal leakage of less than .05 G.P.M. at 3,000 P.S.I. with static friction of less than 12 inch-pounds is an accomplished fact in actuators having internal seals of a total length exceeding 20 inches. A lower value of internal leakage is practical at the expense of increased static friction.

REMEMBER, CLEMCO HYDRAULIC ACTUATORS ARE CUSTOM DESIGNED

for all modern aircraft and missile applications and can be furnished in an almost unlimited variety of envelope sizes, torque ratings, and dynamic spring constants.

CLEMCO AERO PRODUCTS, INC. are furnishing the leaders of the aircraft and missile industry with the following:

- ROTARY ACTUATORS
- POWER STEERING UNITS
- FLUTTER DAMPERS
- MISSILE FINS AND SPARS
- PROPRIETARY DESIGNS OF HYDRAULIC AND PNEUMATIC UNITS FOR MILITARY AND COMMERCIAL AIRCRAFT, AND MISSILES

Write for complete Clemco folder to

CLEMCO

AERO PRODUCTS, INC.

210 E. Manville St., Compton, California

This is #5 of a continuing series of advertisements prepared especially for the advancement of the aircraft industry by CLEMCO. Keep a file of them so you will have the complete story of CLEMCO.

AVIATION CALENDAR

(Continued from page 5)

Jan. 20—Winter Meeting, Provisional Western States Section, The Combustion Institute, California Institute of Technology, Pasadena, Calif. For details write: Mr. G. S. Bahn, Marquardt Aircraft Co., Van Nuys, Calif.

Jan. 20-Feb. 7—Aviation Institute for Commercial Carriers and Business Pilots, Univ. of Southern California, Los Angeles.

Jan. 22-26—International Air Show & Exposition, Master Field, Miami, Fla.

Jan. 29-31—Fourth Annual Meeting, American Astronautical Society, Main Auditorium, Engineering Societies Bldg., 29 W. 39 St., N. Y. C.

Jan. 30-31—American Society for Engineering Education, 1958 College-Industry Conference, University of Michigan, Ann Arbor, Mich.

Jan. 30-31—Seventh Annual Instrument Short Course, sponsored by Southern California Meter Association and Los Angeles Harbor Junior College, at Los Angeles Harbor College, Wilmington, Calif.

Feb. 3-4—Industry-Service Symposium, Flight Control-Panel Integration, Biltmore Hotel, Dayton, Ohio. For details: Mr. J. H. Kearns, Box 942, Dayton.

Feb. 19—"Are Flying Saucers Fact or Fancy?", Dr. Hugh Winn, Missile and Ordnance Systems Department, GE, Engineers Club, 1317 Spruce St., Philadelphia, Pa.

Mar. 13-14—Second National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.

Mar. 17-20—Joint Aviation Conference, American Rocket Society-American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Tex.

Mar. 17-21—1958 Nuclear Congress, managed by American Institute of Chemical Engineers, 25 W. 45 St., N. Y. C.

Mar. 18-19—First Interservice and Industry Symposium on Guided Missiles Training Equipment (limited to those with Secret clearance), Naval Ordnance Laboratory, White Oak, Silver Spring, Md. For details write: Mr. J. G. Vaeth, Head of New Weapons & Systems Division, U. S. Naval Training Device Center, Port Washington, L. I., N. Y.

Mar. 24-29—Fourth International Instrument Show, Caxton Hall, London.

Mar. 30-Apr. 1—RFC-RNAS Reunion, (World War I), Toronto, Canada. Contact: C. B. Stenning, Chairman, 149 South Drive, Toronto 5.

Apr. 8-10—Eighth International Symposia, Electronic Waveguides, Microwave Research Institute of Polytechnic Institute of Brooklyn, Engineering Societies Bldg., 29 W. 39 St., N. Y. C.

Apr. 16-19—14th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

Apr. 17-18—Institute of Environmental Engineers, Second Annual Technical Meeting, New Yorker Hotel, New York.

Apr. 22-24—1958 Electronic Components Conference, Ambassador Hotel, Los Angeles, Calif.

Sept. 1-7—1958 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

40% lighter*... a man can carry it in one hand

30% smaller... he can pass it through a 12" hole

powerful enough to go through 2" thick steel, 5" aluminum

*Weighs only 73 pounds . . . *without sacrificing protective lead-shielding (offbeam radiation level is only 7 mr per hour at 6 feet)*

You can get immediate delivery on a new ANDREX 160 KV lightweight portable unit.
Call any Picker branch office (see local 'phone book) or write
Picker X-Ray Corporation, 25 South Broadway, White Plains, N. Y.

PICKER... one stop for everything in industrial fluoroscopy and radiography

ANDREX lightweight portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV and *Andrescope* X-ray Stress Analyzer.

PICKER x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty, x-ray diffraction apparatus, rayproof inspection cabinets.

ACCESSORIES . . . films, tanks, darkroom sundries, illuminators, *everything.*

TECHNICAL OPERATIONS units for isotope radiography—sources, equipment, containers for Iridium ^{192} Cobalt ^{60} and Thulium ^{170}.

Picker x-ray

The Bell XH-40 turbine-powered 'copter . . . the Army's frontline workhorse of tomorrow

Cutaway cross-section of inboard half of the XH-40 rotor blade showing how the extrusions, machined parts, and contoured aluminum sheets are bonded with Narmco Metlbond 4021.

DISTINGUISHED PERFORMANCE . . . PLUS ECONOMY!

In designing rotor blades for the XH-40, the Army's most advanced utility helicopter, Bell Helicopter engineers were seeking a structural design that would combine outstanding performance with bedrock fabrication economy.

The solution? A uniquely different kind of rotor blade laminated of multiple layers of thin-gage, contoured aluminum sheets, bonded into an homogeneous structure with a high performance, high peel strength structural adhesive. This structure offers a host of performance and fabrication advantages . . . outstanding aerodynamic smoothness, low maintenance, excellent sealing qualities, high corrosion resistance, plus complete absence of assembly distortion. Furthermore, by completely eliminating stress concentrations, the bonded structure takes full advantage of the optimum fatigue life of the blade configuration.

Best of all, the bonded blade design has resulted in a dollar savings of 40 percent as compared with a conventional tapered forging design.

The adhesive used to accomplish the unusually large area bonding required in the fabrication of these laminated blades? A Narmco product, naturally . . . high peel strength, high fatigue resistant Metlbond 4021®. . . one of a great family of sandwich and metal-to-metal adhesives designed specifically to accomplish the toughest jobs in aircraft and missile design.

NEW FROM NARMCO

Narmtape® 108

the first structural sandwich adhesive with built-in fillleting action! Complete technical data available upon request.

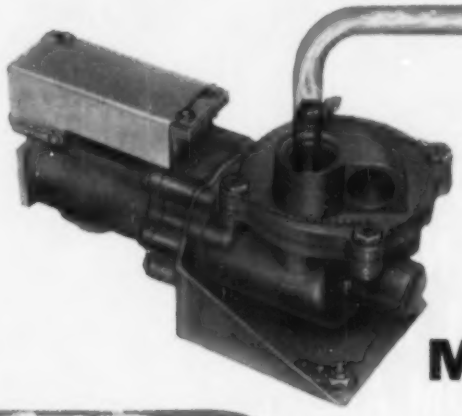
Write today for specific performance and fabrication data on NARMCO structural adhesives. Narmco technical field representatives throughout the United States and Canada can assist in solving your structural design problems quickly, efficiently, economically.

NARMCO

PIONEERING THROUGH RESEARCH

NARMCO RESINS & COATINGS CO., *DEPT. S 18, 600 VICTORIA STREET, COSTA MESA, CALIF.*

LOS ANGELES SEATTLE FORT WORTH DAYTON TULSA PHILADELPHIA TORONTO



MIGHTY MITE

...that pumps up every last drop of fuel even at extreme altitudes!

To scavenge the fuel which would normally be trapped in the lower portions of the fuel tanks—that's the job of Whittaker's AC electric motor operated continuous duty fuel pump!

And this Whittaker Ratio-Flo pump does the job with half the weight and envelope of any other pump – and at extremely high altitudes!

The unit runs continuously after fuel level reaches a pre-determined point (a float switch turns the pump on).

Since entire motor and gear train are submerged, no shaft seals are required. Pump operates on very low current, and is capable of lifting fuel, pumping air and running dry for indefinite periods. Integral motor thermal protection is optional.

PERFORMANCE

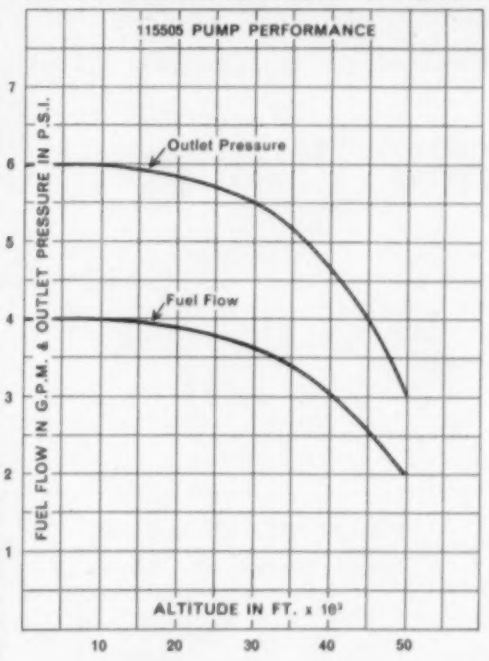
TEMPERATURE. Ambient —65° + 216°F. Fluid —65° + 135°F.

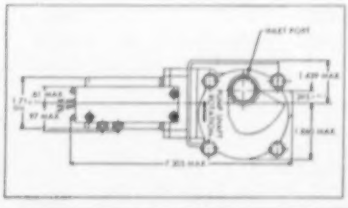
ELECTRICAL POWER REQUIRED. 400 cycle 112V single phase alternating current.

SERVICE FLUID. Aircraft fuels (JP-4 and JP-5)

WEIGHT: 2.75 pounds. ENVELOPE: length, 6¼ inches; height, 3¼ inches; width, 3⅛ inches.

P/N 115505 FUEL PUMP
112V 400 CYCLE SINGLE PHASE MOTOR JP-4 FUEL 60° F





This unit is now in production and suitable for use wherever a fuel scavenging problem exists.

SEND THIS COUPON FOR COMPLETE INFORMATION

Whittaker Controls Dept. 356
915 N. Citrus Avenue, Los Angeles 38, Calif.

Gentlemen: Please send me further information on the Whittaker Scavenger Fuel Pump, P/N 115505

Check one: ☐ Reference information ☐ Project information

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

Whittaker

CONTROL SYSTEMS
Fuel-Hydraulic-Pneumatic
A Division of Telecomputing Corp.
Los Angeles • Seattle • Wichita
Indianapolis • Washington, D.C.
Hempstead, Long Island

J-1300—new iron-base turbine alloy

Easier to forge . . .
higher strength-to-weight ratio
than existing iron-base alloys

New General Electric vacuum-melted alloy J-1300 is specially designed for large forgings, such as turbine wheels, rings, shafts, and buckets. It has the highest strength-to-weight ratio of any iron-base alloy in the 1300° F range.

Its rupture strength at 1300° F is comparable to that of other iron-base alloys at 1200° F. Its minimum guaranteed tensile strength at 1200° F is 135,000 psi.

In addition to its greater strength, J-1300 is more ductile — making it easy to forge. And its improved properties are easy to control and maintain during forging.

G-E alloy J-1300 is currently available in billets and bars. Substantial quantities have been made, and guaranteed minimum specifications are available. For complete technical data, write for Bulletin VM-104. Metallurgical Products Department of General Electric Company, 11107 E. 8 Mile Street, Detroit 32, Michigan.

PROPERTIES OF J-1300

Tensile strength at 1200° F
Ultimate — 135,000 psi
.2% yield — 112,000 psi
Elongation — 12%
Reduction of area — 15%

Rupture strength at 1300° F
65,000 psi — life, 24 hours

Progress Is Our Most Important Product

GENERAL ELECTRIC

At Temco

past performance is the best index to future achievement

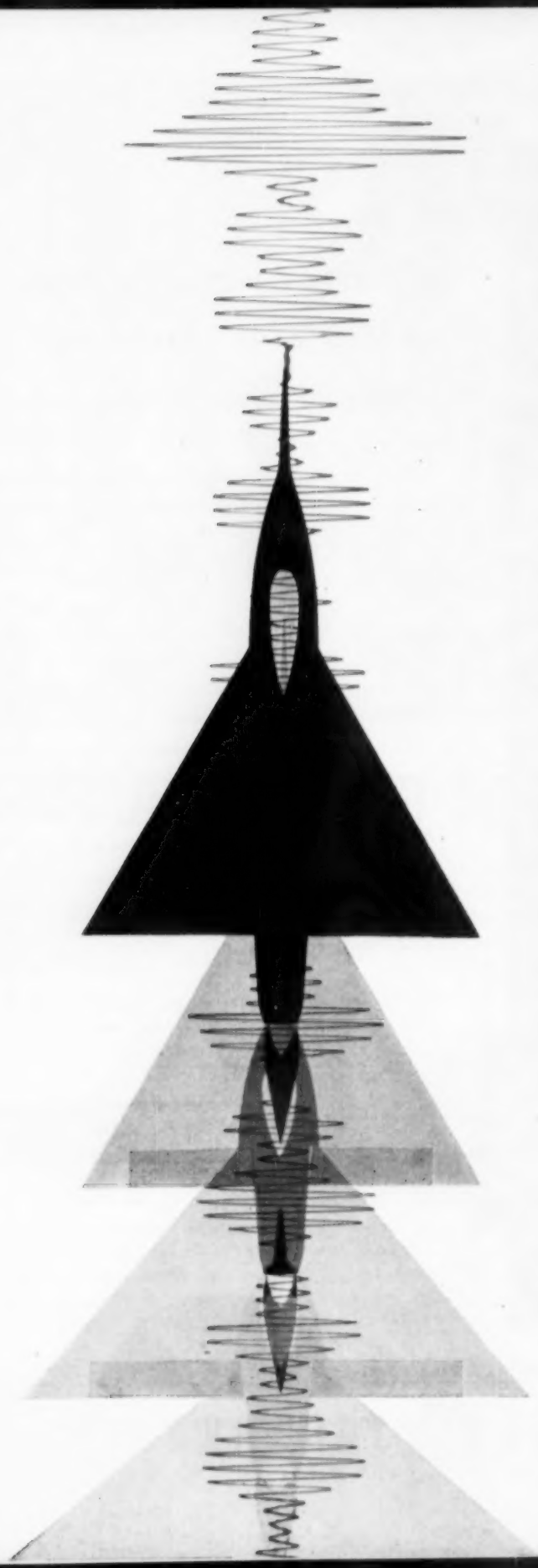
At Temco, more than a decade of planned progress has resulted in an accumulation of know-how and productive capacity that makes Temco's capabilities complete from basic design to precision production.

During these years of growth, Temco's skills and specialized equipment have been applied to the completion of projects that included such diversified operations as electronic and guidance systems, complete aircraft, missiles and weapons systems, launching equipment, turbojet engine components, and the design and production of major components for almost every leading U.S. aircraft manufacturer.

Temco's accomplishments in the future will reflect the experience gained in past performance. If your business is with anything that flies, look to Temco for *complete capability* and *reliability* from *development* through *production*.

TEMCO

AIRCRAFT CORPORATION • *Dallas, Texas*



KEEPING INSTRUMENTATION A STEP AHEAD OF SPEED

AVIONICS IN ACTION AT BURROUGHS: FROM RESEARCH AND DEVELOPMENT TO PRECISION MASS PRODUCTION

Today's dramatic new developments in aircraft performance demand equally dramatic new developments in flight *instrumentation*. And Burroughs is assuming ever greater responsibilities in this field through its work in the brand-new science of *avionics*.

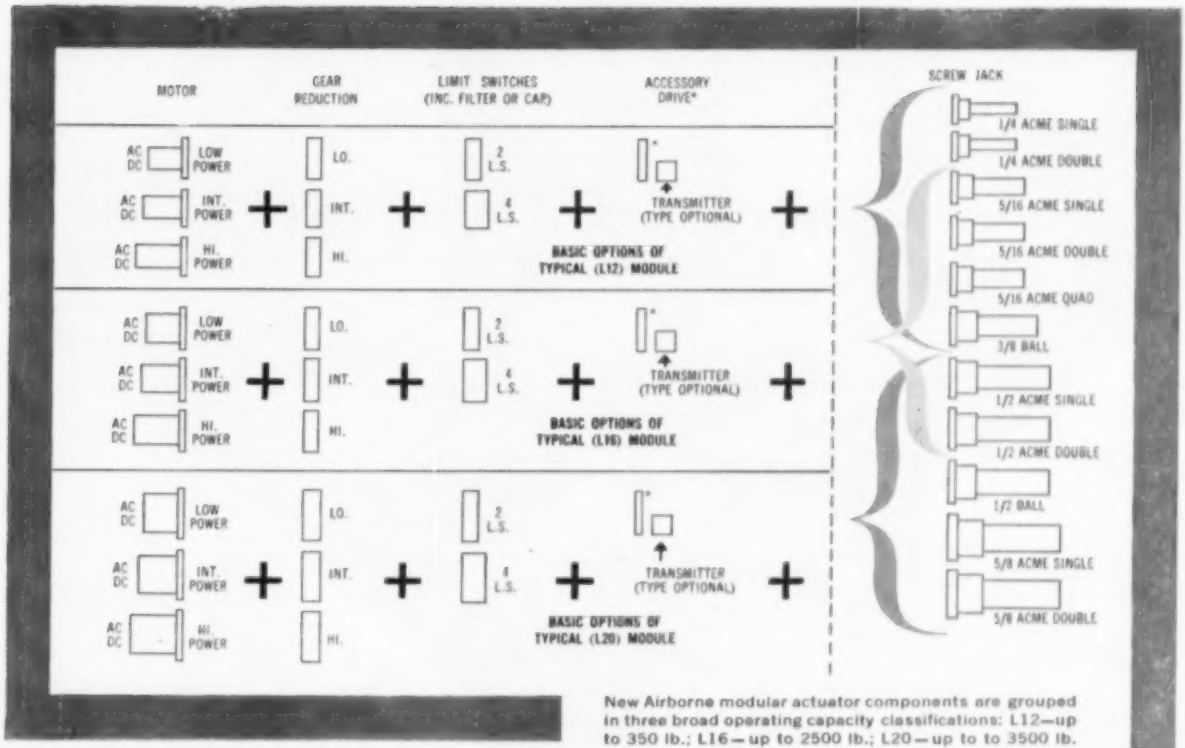
Examples? Past experience in mass production of such instruments as altimeters, accelerometers and gyros. Plus, of course, extensive research and development in totally new concepts of flight instrumentation. And in all these enterprises, *reliability* consistently keynotes our performance.

We have, too, the capabilities and facilities for further research and development in this fast-moving field. And in all areas of our proved responsibility and competence—not only instrumentation but control systems, electronic computation, communications, data processing and others—we stand ready to see defense contracts *all the way* through. Yes, from preliminary research to installation and field service.

Write, call or wire Burroughs Corporation, Defense Contracts Organization, Detroit 32, Michigan. Or Burroughs Defense District Offices: Paoli, Pa. • Dayton, Ohio, 3898 Linden Ave. • Encino, Calif., 17071 Ventura Blvd. • Washington, D.C., 1739 "H" St. N.W.

BURROUGHS

THE FOREMOST NAME IN COMPUTATION

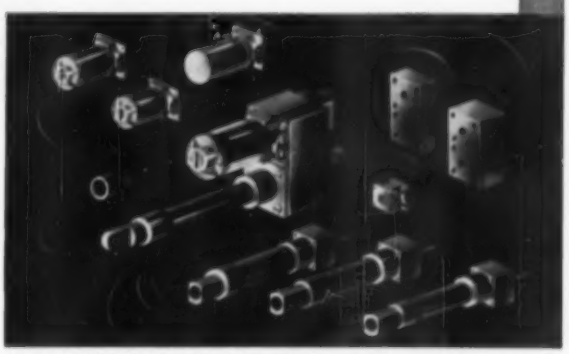


New Airborne modular actuator components are grouped in three broad operating capacity classifications: L12—up to 350 lb.; L16—up to 2500 lb.; L20—up to to 3500 lb.

FROM THESE BASIC AIRBORNE COMPONENTS YOU CAN SPECIFY
OVER 300 DIFFERENT ACTUATOR PACKAGES

New Airborne modular actuators give you more design freedom, help eliminate costly specials

With Airborne's new modular actuators you are no longer limited to a line of, say, a dozen standard models whose design is relatively fixed. Instead you can now specify any one of several hundred different actuator packages assembled from standardized, interchangeable Airborne components. In 90% of the cases this will give you a linear actuator exactly meeting your capacity and configuration requirements. You enjoy greater design freedom and reduce the expense and delay associated with specials. Write today for full information.



Simplified illustration shows how Airborne modular actuator can be assembled from various combinations of standardized, interchangeable parts. With several hundred combinations possible, your design problems are simplified; and specials are largely eliminated.

LINEATOR® • ROTORAC® • TRIM TROL® • ROTORETTE® • ANGLgear® ROTOLOK

AIRBORNE®

AIRBORNE ACCESSORIES CORPORATION

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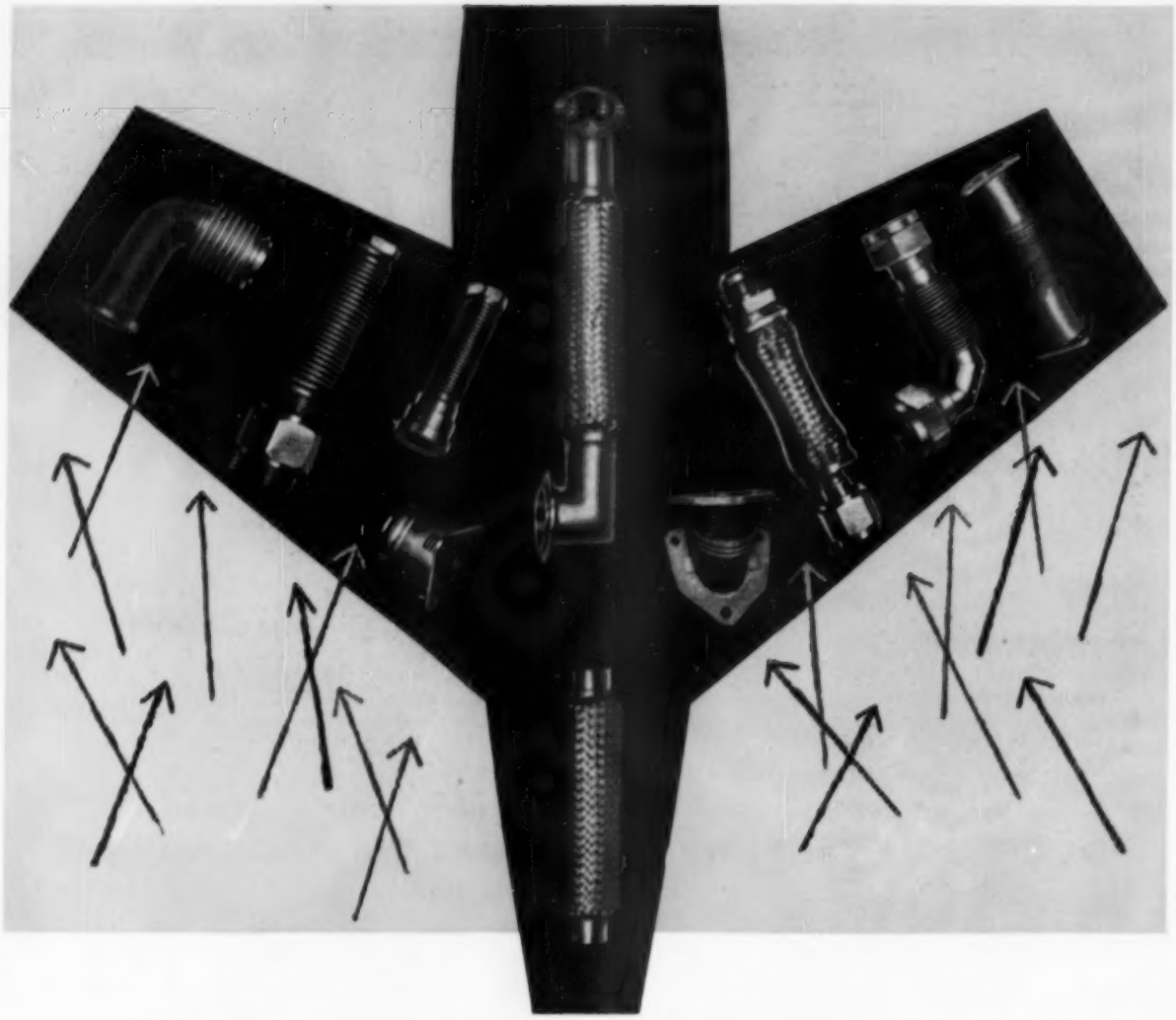
Represented in Canada by: WINNETT BOYD LIMITED • 745 Mt. Pleasant Rd., Toronto 12, Ont.

NEW MODULAR ACTUATOR CATALOG 57A

Treats of the modular design concept; shows operating capacity curves for the new Airborne actuator classifications; contains complete dimensional data. Write for a copy today.



SYLPHON® BELLOWS FLEXIBLE CONNECTORS simplify design and operation of STRESS-LOADED AIRCRAFT COMPONENTS

Fulton Sylphon STAINLESS STEEL connectors possess enormous built-in fatigue resistance. They stubbornly withstand high temperature and pressure stresses; vibration, pulsation and shock conditions; constant flexing and the corrosive action of synthetic lubricants and certain gases.

These versatile connectors are available, to specifications, in numerous shapes and sizes to connect shafts, pipes, misaligned and/or shifting terminals. Single or multiple ply types . . . and braid-covered construction, when indicated, to offset various abrasive and heavy-pressure conditions.

Sylphon Bellows Flexible Connectors are made by America's foremost manufacturer of bellows and bellows assemblies for innumerable applications. Engineering skills and production know-how are rooted in 52 years of specialized experience in this field.

For complete design and catolog data, send for Engineering Bulletin 1400-XA.

Mr. Controls®

Robertshaw-Fulton CONTROLS COMPANY • FULTON SYLPHON DIVISION

Knoxville 1, Tenn.

Getting specific about gravity!

Falling apples fascinated Sir Isaac Newton. No doubt he enjoyed a few of them while devising his famous gravitational formulas. Newton's concern was with what came down, whereas aviation engineers today are primarily concerned with what goes up. Even so, the gravitational challenge is the same.

A jet plane, intercontinental missile—or anything that moves — usually leaves the design stage too heavy for optimum performance. To be specific — the specific gravity of the material of construction is too high.

Now, with Titanium, the design engineer can capture the strength of alloy steel at barely more than half the weight. What's more, Titanium is unaffected by most corrosives . . . and is impervious to the deadly attack of sea water and marine atmospheres. Its coefficient of expansion is low . . . and it can withstand long-time operating temperatures as high as 1000°F.

All types of Titanium mill products, from foil to seamless tubing, are made by TMCA. With production going up and prices going down, now is a good time to design with Titanium. Technical literature on Titanium is available just by asking.

. . . FIRST IN Titanium

TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.

Another famous plane

PROVEN IN SERVICE

1929

For the first time a complete "blind" flight is successful. A Sperry Gyro Horizon and Directional Gyro is used in a Consolidated NY-2 over a 15-mile course.

Twenty-eight years ago the first all-instrument flight was a number one topic in the aviation industry — today it is but another memory of the "Good Old Days" of aviation. But even in 1929 Rockbestos wire and cable had earned a proven-in-service reputation.

Today, Rockbestos can look back on 39 years of developing and manufacturing quality wire and cable, and a long history of close association with the aviation industry.

Rockbestos has continually produced high temperature wire which meets the exacting standards of modern airplanes . . . both military and commercial.

And Rockbestos will continue to develop wires to meet the aircraft industry's needs. Find out just how Rockbestos can help solve your high temperature wiring problems. Write, wire or phone for complete specifications and application information.

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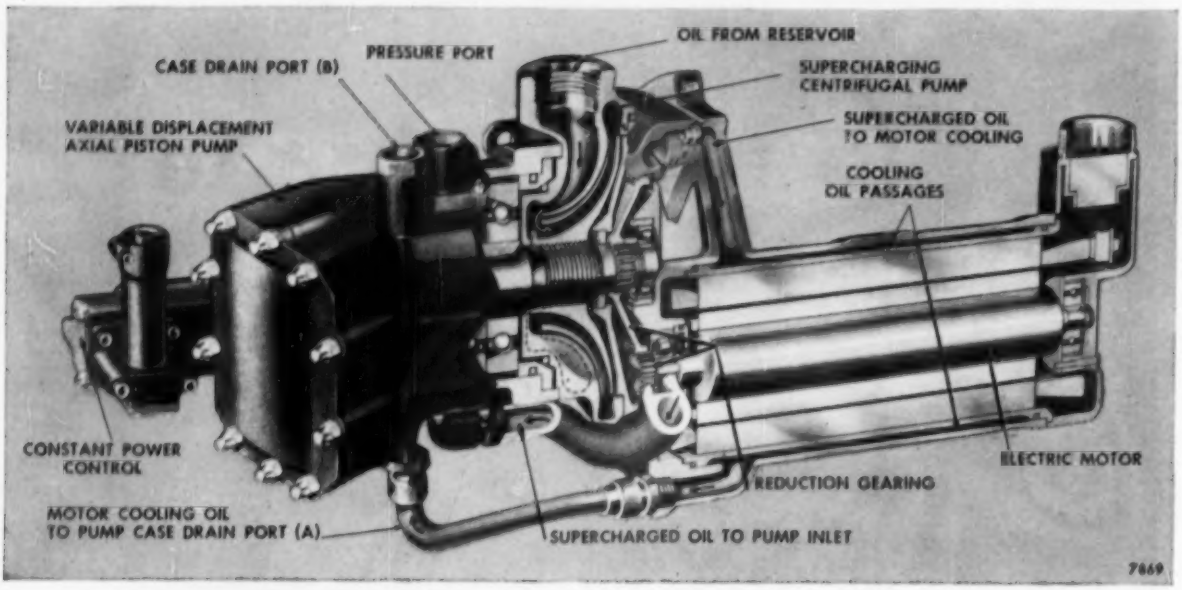
New Vickers OIL COOLED Motorpump

For Continuous Duty Applications



Installed weight approximately 25% less; also offers significant size reduction

The 12 horsepower oil cooled motorpump shown above weighs 31¼ lb and is 20" long overall . . . motor diameter is less than 4". This represents a substantial saving in weight and size over the conventional air cooled motorpump. Also, there is a further saving with the elimination of duct work in the airframe normally required for air cooling the electric motor. The motorpump illustrated *is now in quantity production* for turbine powered transports.

The time-proven Vickers variable displacement piston type pump, which is an integral part of this "package", delivers up to 8 gpm at 2250 psi, reduces to 6 gpm at 2950 psi and zero flow at 3000 psi. These flow and pressure combinations (8 to 6 gpm range) provide constant horsepower for a variety of flight operating requirements. It is designed for *2000-hour* service.

A centrifugal boost pump is located between the pump and the 400 cycle, 200 v electric motor; in addition to supercharging the pump, it circulates oil through the double-walled motor casing. Cooling oil from the motor jacket is discharged into one case drain port (A) . . . then out port (B) to a heat sink. At full pump flow, the impeller provides 2 gpm to the motor casing.

• The 12 horsepower unit described above is typical of the Vickers motor and pump combinations now available to the aircraft industry as "packaged power" for continuous duty applications. Remarkable records for reliability in both military and airline service have been established by Vickers designed motorpumps.

Higher Overall Efficiency

Overall motorpump efficiency (hydraulic power output to electric current input) is 75%. This is possible only because Vickers Piston Pumps have an overall efficiency of 92%. The more efficient pump means the use of a smaller, lighter electric motor, minimum heat transfer to the hydraulic circuit, and less current drain.

Heat Rejection Control

The oil cooled motor design offers a definite advantage in that heat dissipated (140 Btu per minute, maximum) can be conveyed readily to a remotely located heat sink. This is one reason why optimum performance for a given weight and size is more readily achieved in a liquid cooled unit.

High Altitude Operation

Motor operation is not affected by low air density since it is not dependent upon air cooling. Inclusion of centrifugal boost pump prevents piston pump cavitation above 30,000 ft, even though reservoir is vented to atmosphere.

Constant Power Control

The constant horsepower control shown on the above unit is optional, depending on the application. The control maintains constant 3000 psi pressure as flow increases until the electric motor is loaded to its maximum horsepower. Additional flow is then available at reduced pressure to maintain the same horsepower load on the motor. This type of control is particularly advantageous for low force, high capacity (flow) and high force, low capacity applications while staying within the limits of recommended electric motor load ratings.

Packaged Unit

The axial piston pump, centrifugal boost pump, reduction gear and electric motor are all integrated into an exceptionally compact and high-performance package. This concept also permits a high degree of design flexibility to meet individual requirements.

Sound Insulated

Because air ducts are not needed to dissipate motor heat, the oil cooled motorpump can be sealed in a compartment and effectively sound insulated.

Additional Advantages

Low frictional starting torque characteristics of the 12 horsepower unit permit acceleration to maximum speed in less than 200 milliseconds. The electric motor meets the military specifications for explosion-proof operation.

For further information contact the nearest office listed below.

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December 9, 1957

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Army Partisans Rap Aircraft Industry 26
▶ Memorandum declares automobile industry fathered mass production and could best produce IRBMs.

Inadequate Facilities Jeopardize Jet Era 40
▶ Airline jet operations could fail completely without adequate ground equipment, and hardly any is available today.

Sabreliner Fits USAF Shelf Item Concept 53
▶ North American's twin-jet utility trainer is being pushed to meet a scheduled May 15, 1958, rollout date.

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COVER: North American F-107A fighter-bomber takes off carrying fuel pod under belly. Vertical partition in center of the overhead intake forms first inlet shocks. Three vertical stripes on fuselage under all-movable vertical stabilizer indicate location of turbines in the Pratt & Whitney J75, rated at more than 15,000 lb. thrust (AW Nov. 25, p. 27). The F-107A is approximately 62 ft. long, 19 ft. high, has about 37 ft. wingspan.

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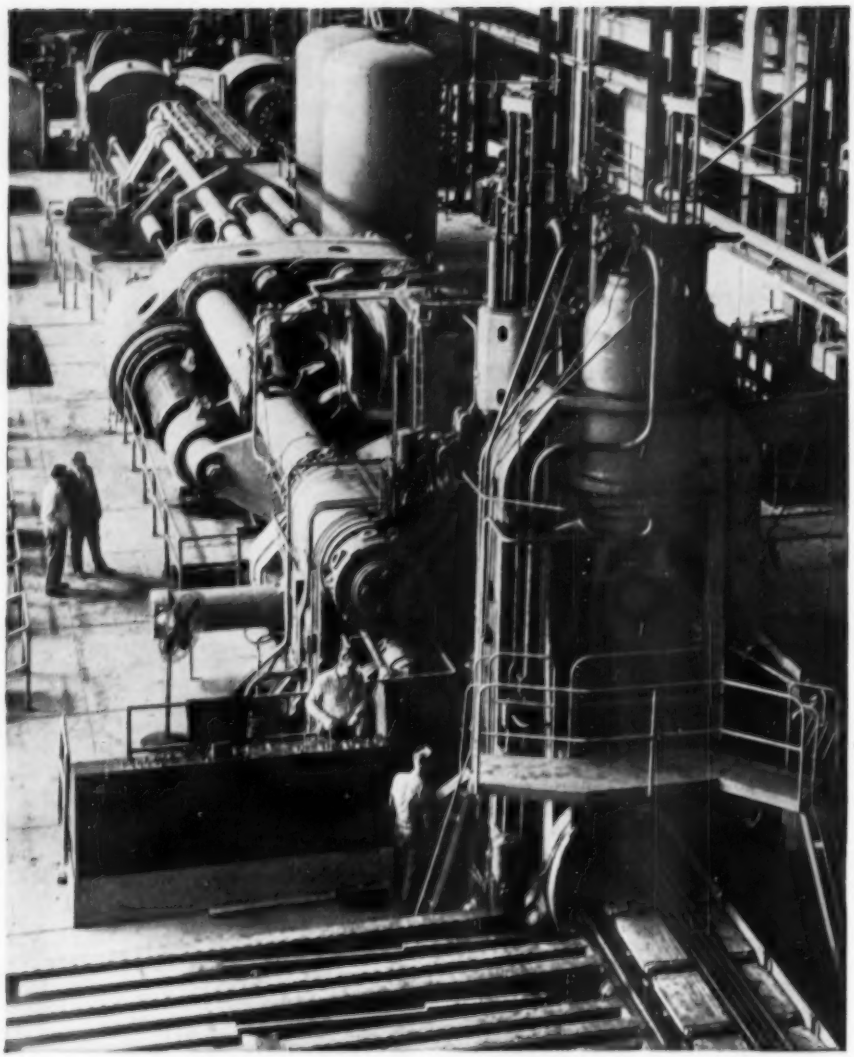
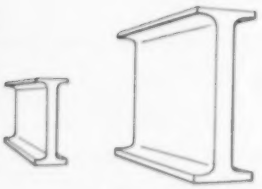
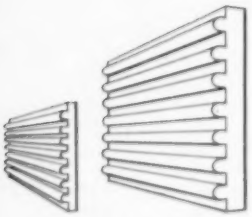


HOW THE 13,200-TON PRESS BOOSTS EXTRUSION CAPACITY



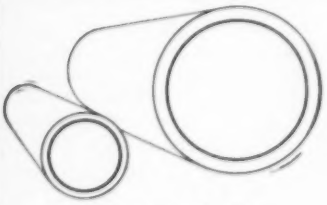
FROM 11" TO 28"

STRUCTURAL SHAPES



FROM 9" TO 20"

STIFFENED SECTIONS



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EDITORIAL

Perspective for the Space Age

Recently we listened to Gen. Thomas White, Air Force Chief of Staff, present what strikes us as the best exposition we have heard yet on how military technology is developing from the conventional winged aircraft we now see in the sky to the conquest of space. Gen. White outlined Air Force policy in this revolutionary period in a speech to the National Press Club in Washington, reported in detail on page 28 by AVIATION WEEK's Military Editor Claude Witze.

However there are some major issues raised by Gen. White that merit further editorial discussion. Gen. White is perhaps the broadest gage leader the Air Force has been fortunate to have as its chief in the decade since its birth as a separate service. In addition to his professional competence as a military airman, Gen. White has other varied talents. He is an accomplished linguist, knowing such knotty languages as Russian and Chinese, and he is a talented ichthyologist, who with his wife, is credited with identifying new species of fish, adding to man's knowledge in that field. It is particularly significant that the Air Force has a leader of Gen. White's broad outlook for this vital period when as an organization it must expand its own vision and sphere of operations on a scale undreamed of by the American people only a few years ago.

Gen. White made it crystal clear that the Air Force has been fully aware of the military importance of controlling outer space and has been working toward that goal for nearly a decade.

"Whoever has the capability to control the air is in a position to exert control over the land and seas beneath," Gen. White said. "I feel that in the future whoever has the capability to control space will likewise possess the capability to exert control of the surface of the earth. We airmen who have fought to assure that the United States has the capability to control the air are determined that the U. S. must win the capability to control space.

"In speaking of control of the air and control of space I want to stress that there is no division per se between air and space. Air and space are an indivisible field of operations. Ninety-nine per cent of the earth's atmosphere lies within 20 miles of the surface of the earth. It is quite obvious that we cannot control the air up to 20 miles above the earth's surface and relinquish control of the space above that altitude—and still survive."

These are paragraphs that should be studied by every legislator, hung on the walls of Air Force ready rooms around the world, and understood clearly by every citizen of this land. Here is a clear clarion call to the future that must be heeded if we are to survive as a nation and as a force for enlightened leadership in this world and whatever other habitable areas are discovered in the planetary system.

It is appropriate to emphasize that this is not a new discovery of its future by the Air Force. In the research and development area USAF has been laying a sound technical foundation for its evolution into space.

The Air Research and Development Command has been pushing an imaginative and technically sound space research program for years within the meager resources made available by higher authority for this purpose. The Aerobee sounding rocket, the Farside firings at Enewitok, the Moby Dick high altitude balloon program, the zero gravity experiments by the School of Aviation Medicine and the rocket powered experimental aircraft have been chipping away steadily at our vast ignorance of space problems. The experiments of the Space Biology Laboratory at Holloman Air Force Base with fruitflies, monkeys, dogs, pigs and bears are all aimed at accumulating the knowledge necessary to put man into space safely and usefully.

Technical brains of the aviation industry have not been lagging in this field either. But such proposals as the Lockheed Pied Piper manned reconnaissance satellite (AW Oct. 14, p. 26) and the Bell Bomi hypersonic glide bomber (AW Dec. 2, p. 28) were rejected by the "practical men" who ran the Defense Department for the last five years—men who were not interested in "why potatoes turn brown when fried" or the other side of the moon. With proper financial and political support there is no reason to doubt that the Air Force and the aviation industry can establish and maintain control of space.

Gen. White also offered the first really lucid and technically sound picture of how the mixture of missiles and manned vehicles moving through air and space must be integrated into an overall mission system concept. We have seen too much technically naive nonsense in mass communications media lately on how ballistic missiles are the "ultimate" weapon and how we should push their development at the expense of almost everything else. Gen. White pointed out clearly —and this is the first time a responsible military leader has done so—the basic and inherent limitations in the use of ballistic missiles regardless of their range or the accuracy of their guidance.

"In the future I see integrated forces of manned and unmanned systems, for missiles are but one step in the evolution from aircraft to true space craft," Gen. White said. "It will take both manned and unmanned systems to perform our mission because in the future the essentials for success will still be quick reaction, reliability, flexibility and versatility. If manned systems can perform some tasks better, we want manned systems; if unmanned systems can do the job then we will be the first to accept them and use them.

"The point I want to make is that in the context of the Air Force's mission and combat technology manned aircraft, unmanned missiles, and manned space craft join together in compatible and complementary roles to form a functionally complete system."

Control of space is as vital to this country's future as was control of the air during World War II. It is encouraging to see tangible evidence that USAF leadership is dedicated to achieving this goal in sound technical steps. We hope Gen. White and other top USAF leaders will continue their efforts to develop the public support for their program they require if it is to get the resources necessary for its ultimate success.

—Robert Hotz

On the threshold of a frightening yet fascinating new age, The Kaman Aircraft Corporation would like to express its gratitude to and confidence in the only nation in the world which is truly a government of, by and for the people. To all who are working to keep it that way warmest greetings of the season and heartiest wishes for a prosperous and peaceful new year.

THE KAMAN AIRCRAFT CORPORATION

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WHO'S WHERE

In the Front Office

Page Golsan, a director and a member of the executive committee, Servomechanisms, Inc., New York, N. Y.

Duane E. E. Roland, a director, Synthane Corp., Oaks, Pa.

Edward H. Fisher, president, Tube Reducing Corp., Wallington, N. J.

Cmdr. G. O. Noville (USNR, ret.), president, newly formed Townsend Engineered Products, Inc., subsidiary of Townsend Co., Santa Ana, Calif. Also: **Robert H. Aaron,** vice president-administration; **Samuel L. Sola,** vice president-engineering; **Charles F. Schultz,** production superintendent.

Richard R. Pettit, executive vice president, Transocean Corporation of Calif., Oakland, Calif.

North American Aviation, Inc., Los Angeles, Calif., has announced the election of the following vice presidents: **Leland R. Taylor,** assistant to the president; **Joseph G. Beerer,** general manager-Missile Development Division; **John R. Moore,** general manager-Autonetics Division; **Samuel K. Hoffman,** general manager-Rocketdyne Division.

Joseph F. Degen, vice president-manufacturing, Weston Electrical Instrument Corp., subsidiary of Daystrom, Inc., Murray Hill, N. J.

Honors and Elections

The National Aeronautic Association has announced that the following awards will be made at the Wright Memorial Dinner on Dec. 17:

Edwin A. Link, inventor of the flight simulator and other aviation training devices, will receive the 1957 Frank G. Brewer Trophy Award for the advancement of aviation education.

Charles J. McCarthy, board chairman, and associates at **Chance Vought Aircraft,** and **Vice Adm. James S. Russell,** USN, and associates at the **U. S. Navy Bureau of Aeronautics,** will be the joint recipients of the Collier Trophy Award for 1956 for conception, design and development of the F8U Crusader jet fighter.

John S. Anderson has been elected chairman, and **Joseph H. Tippets** has been elected vice chairman of the Radio Technical Commission for Aeronautics, Washington, D. C. Mr. Anderson is president of Aeronautical Radio, Inc., and Mr. Tippets is Director of CAA's Office of Air Navigation Facilities.

Changes

Lloyd E. Thompson, supervisor-engineering analysis group, Weber Aircraft Corp., Burbank, Calif.

Ferdinand P. Diemer, director of engineering, Cal-Tronics Corp., Los Angeles, Calif.

J. R. Bradford, public relations officer, Bristol Aeroplane Company, Ltd., Bristol, England.

John M. Heldack, manager of marketing, Aircraft Accessory Turbine Dept., General Electric Co., Lynn, Mass.

INDUSTRY OBSERVER

► Ignition for Polaris fleet ballistic missile occurs while the Navy-Lockheed missile floats free in the water. Missile can be ejected from a surface vessel or submarine by a torpedo motor first stage or simply dropped overboard with ballast located to stabilize it in firing position. Firing will take place a safe distance from the ship and would be programmed to launch as the missile rolls into a vertical attitude. Tactical use may see Polaris planted like a naval mine to fire minutes or hours after ejection. This would prevent enemy from retracing the trajectory of the missile to find launching vessel.

► **Guidance for USAF-Douglas Thor intermediate range ballistic missile will consist entirely of self-contained inertial guidance system made by A.C. Spark Plug. Back-up program for ground-based radio command guidance being developed by Bell Telephone Laboratories will be dropped. The decision stems from improved reliability and accuracy now obtainable with inertial guidance. Army's Jupiter IRBM also employs self-contained inertial guidance only. Firing schedule at Patrick AFB, Fla., for Thor includes two launchings this month for further checkout of guidance system and another firing in January of complete missile with nose cone.**

► Aerial refueling tests involving Convair's B-58 supersonic bomber and Boeing KC-135 jet tanker have shown an excellent compatability between the two aircraft and confirm the range potential originally envisioned for the B-58.

► **Flying Saucer Research at A. V. Roe Canada Ltd., Malton, Ontario, is still being supported by USAF Air Research and Development Command. Details of saucer configuration laid down a few years ago at Avro have been modified and refined.**

► Joseph T. McNarney, president of Convair Division of General Dynamics Corp., will retire Jan. 1 and will be succeeded in this position by J. V. Naish, now executive vice president of Convair.

► **Length of cargo compartment in Russia's new Mil-6 twin-turbine helicopter which has a 12-ton payload (AW Nov. 11, p. 30) is approximately 39.5 ft. Soviet sources say helicopter's overall length is "approximately the same as for two railroad passenger cars"—160-170 ft. Mil-6 has carried 26,468 lb. payload to altitude of 7,872 ft. within 11 minutes after takeoff.**

► Navy has deferred consideration of order for Convair P6Y antisubmarine aircraft until Fiscal 1958. Navy is now leaning heavily towards ordering ASW version of Lockheed Electra turboprop transport.

► **Nose cones for Thor intermediate range ballistic missile and Convair's Atlas intercontinental ballistic missile are being manufactured by General Electric's Missile and Ordnance Systems Department in Philadelphia, while the nose cone for Navy's Polaris fleet ballistic missile is being handled by the company's Chemical and Metallurgical Products Department in Pittsfield, Mass.**

► Soviets may be shielding the engine tail pipes and intakes of their jet bombers in an effort to reduce vulnerability to infrared-guided missiles.

► **First flight of A. V. Roe Canada Ltd.'s CF-105 Arrow (AW Oct. 21, p. 50) probably will be made in January following completion of the interceptor's taxi trials.**

► North American Aviation's Columbus Division is scheduling the roll-out of its new T2J-1 two-place jet trainer for late this month. First flight of the basic trainer, powered by a Westinghouse J34, is planned for late next month or early February.

► **Both Thor and Jupiter IRBMs are designed for adaption to mobile launchers for firing.**

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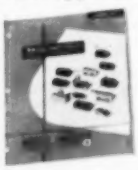

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Washington Roundup

'Window Dressing' for Sputnik

Current opinion of some knowledgeable military and industry people involved in the missile program is that the situation is going to get worse before it gets better. "Window dressing" is the label most frequently put on moves of the past few weeks intended to speed the program, break bottlenecks, get the IRBMs rolling. These attitudes were evident two or three weeks before Democratic critics exploded last week with a charge that the Eisenhower Administration still feels no sense of urgency despite the success of Soviet Sputniks (see page 31).

Major disappointment to the Air Force is William M. Holaday, Defense's director of guided missiles, who still shows no signs of clarifying the program to put Jupiter and Thor into production. Clear program and clear decision-making are in no greater supply than when Trevor Gardner quit as USAF Assistant Secretary for Research & Development.

Overheard from a high-ranking officer: "This muddle is just as bad as ever. I guess it won't hurt now, but we will suffer for it in five years."

Appearing before the Senate Preparedness Subcommittee, Defense Secretary Neil H. McElroy agreed under repeated questioning that Holaday has only "coordinating" and not "directing" authority and that the authority of Dr. James R. Killian, the President's science adviser, is only advisory.

Interesting sidelight is that the man who has won most respect from USAF and others for his objectivity and intellectual honesty is an Army officer: Brig. Gen. A. W. Betts, Holaday's military executive assistant.

Pentagon Fears

No one has mentioned it out loud, but one of the major terrors lurking in Pentagon corridors is the possibility that the Defense Department will lean to a Ministry of Supply concept as practiced by the British. First step, some wary individuals fear, will be the choice of a single manager for new and advanced weapon systems even if it is only for development.

On top of this, Defense Secretary Neil H. McElroy says he would like to see more research and development funds for the Defense Department itself along with more flexibility in the application of funds. U.S. military men are convinced that the British system, where a separate ministry picks out the goods and hands it to the using command, is a poor one.

Another major possibility is that McElroy will consider a revision of the roles and missions of the armed services. He told the Senate Preparedness Subcommittee that the Army wants to develop a 500-mi. version of its Redstone missile. Former Defense Secretary Charles E. Wilson a year ago shifted operational use of all land-based IRBMs to the Air Force and limited Army to a 200-mi. range for ballistic missiles. If Army is allowed to develop the longer-range missile, McElroy said, the Joint Chiefs might then be asked to reconsider the range limit. Army is optimistic about this change as well as an increase in the weight limitations on its aircraft.

Science Advisory Shift

Science Advisory Committee is being transferred from the Office of Defense Mobilization to work directly with the White House and James R. Killian, Jr., President Eisenhower's new special assistant for science and technology. Five new members also were added to the new committee, boosting the total membership to 19. New members are James H. Doolittle, chairman of the National Advisory Committee for Aeronautics; Dr. R. F. Bacher, California Institute of Technology; Dr. E. M. Purcell, Nobel Laureate, Harvard University; Dr. Herbert York, University of California, and Dr. George B. Kistiakowsky, Harvard University.

Military Pay Push

The Administration has finally decided to push vigorously the Cordiner plan for an "incentive" type military pay system, but it faces strong opposition in the Congress. The plan, designed to reward skill and merit and help the military retain hard-to-train technicians, was worked out by a Defense Department advisory committee headed by Ralph J. Cordiner, president of General Electric Co. (AW Feb. 4, p. 37).

Sen. John Stennis (D.-Miss.), chairman of the Senate Armed Services Subcommittee considering the proposal, declared: "I have never known one single proposal to have as much said about it with as few supporting facts as there is about the Cordiner report."

Noting that the Cordiner system has been represented as a measure to give incentive pay raises to keep men in military service, Stennis said: "I have noted that the raises apply to men already retired." He complained that a questionnaire he sent to the Defense Department in July to obtain "some proof" of the merits of the Cordiner plan has never been answered.

Perennial Debate

Perennial talk without any action over a site for a second airport to relieve Washington's overtaxed National Airport moved into the public hearing stage last week with Presidential Assistant Elwood Quesada presiding. Quesada, also chairman of the Airways Modernization Board, has until Jan. 15 to decide which of four possible sites he will recommend to Congress as the location of the proposed airport.

Maryland is staunchly supporting Baltimore's Friendship Airport and has suggested the construction of a railroad spur line between the field and Washington. Virginians are widely split over the location of an airport on the three remaining sites, all of which are located on the Virginia side of the Potomac. The Washington Board of Trade is backing Burke, Va., as the most convenient location, a stand also taken several years ago by airlines operating into the area.

Industry Summons?

Senate Preparedness Subcommittee may summon prime missile contractors to Washington to get their views on just how and why the U. S. fell behind the Soviet Union in the technological race and what should be done about it. The subcommittee, headed by Sen. Lyndon Johnson (D.-Tex.), already has heard from leading scientists and top Defense Department officials in its investigation of the U. S. defense effort. Final decision as to whether to ask the contractors to Washington will depend upon the results of a questionnaire the subcommittee is now circulating among the manufacturers.

—Washington staff

Army Partisans Rap Aircraft Industry

Memorandum declares automobile industry fathered mass production and could best produce IRBMs.

By Claude Witze

Washington—Victorious in their long fight to have the arsenal-developed Jupiter intermediate range ballistic missile ordered into production (see page 27), U. S. Army partisans are now preparing to prove that the automobile industry is the true father of mass production methods used in the aircraft industry and can out-produce the aircraft industry in missiles.

In addition, there are definite indications that Army is determined to outmaneuver the Air Force on other fronts, starting with the anti-missile missile and reaching into the area of space satellites, manned and unmanned.

Some Army spokesmen already are talking about an anti-satellite satellite. Tentatively coded the Burro project, it would be capable of leaving its own orbit to destroy another satellite launched by an enemy power.

Rough outline of the Army approach on the subject of mass production is contained in an inter-office memorandum brought to the attention of AVIATION WEEK. The document indicates it was prepared in Army's Office of Public Information.

"Modernization of aircraft construction," the memo says, "was actually accomplished by the auto industry.

"The prime contractor for the Jupiter is the Chrysler Corp., an automobile industry familiar with the problems of true mass production. It appears reasonable . . . that if they were given a contract to mass produce Jupiter, they would be able to introduce auto industry as opposed to airplane industry methods of construction.

"This should provide a cheaper end-product available at a greater rate than that which the aircraft industry can do."

The memorandum indicates that Maj. Gen. H. P. Storke, chief of Army public information, has been "upset" by news stories describing the USAF weapons system approach to IRBM design as applied to the Thor by Douglas Aircraft Corp.

Simultaneous development of a production line and support equipment so that the weapon can be quickly moved into production and ready to use when it is delivered have characterized the Thor under management of USAF's Ballistic Missile Division. Output, along with training and logistic support, can be expanded swiftly with production under way (AW Dec. 2, p. 26).

The Army memo says Gen. Storke is convinced newspaper and magazine stories on Thor's producibility, growing out of the five-year-old Weapon System Concept, have been "leaked." To offset their effect, the memo calls for data on "our most optimistic production schedule on Jupiter."

In addition, the Army author makes these observations:

"I would like—so that it can be on the 2:30 messenger run— a short piece or collection of ideas which will develop the theme that mass production as used by the airplane industries is not synonimous (sic) with the public conception of mass production.

"The public, when you say mass production, visualizes a conveyor system which begins with a piece of metal at one end and people standing around adding small parts—and the final result is that the finished job pops out at the other end.

"This is, in fact, not true.

"Mass production by the aircraft industry is very similar to the so-called hand production carried on at Redstone. In other words, a portion of the missile is put on a dolly and the assembly is moved to other dollies attached to the missile frame. There is no conveyor system and there is no assembly lines."

Photographs of the Douglas Thor assembly line are in the Pentagon and are being held from public release on orders from Donald A. Quarles, Deputy Secretary of Defense.

The Army memo calls for written material emphasizing the claim that there is no assembly line in a modern aircraft factory. In addition, it calls for emphasis on the Army assertion that "it took the automobile industry to introduce mass production into the Air Force."

The document adds that, "prior to the construction of the Willow Run plant by Ford, and the Dodge Engine Plant in Chicago and the General Motors Assembly Plant in Michigan, there was no such thing as mass production even as the airplane industry uses the term today."

Aircraft industry spokesmen quickly pointed out that major aircraft plants, including that of Douglas, do have moving lines similar to those in auto plants. This has been true since World War II and, during that war, production experts and engineers from aircraft companies were called in to help auto firms learn to build aircraft.

This was true in the case of aircraft—Consolidated Vultee and Douglas representatives worked on the Ford line at Willow Run—and in the manufacture of aircraft engines by auto makers. The Ford line for building aircraft engines during the war was established for Ford by Pratt & Whitney.

Actually, aircraft and automobile assembly methods are similar with the major exception that the aircraft industry works to much closer tolerances, assembly must be more precise, and there must be provision for incorporating design changes on the line. The Army memo laid down precepts that have been made evident as part of that service's doctrine for several months.

Most recent signs of the Army effort to preserve the concept of development by its arsenals have been in connection with future work in the missile and satellite field.

Defense Secretary Neil H. McElroy is expected to create a new top-level executive to take charge as a single manager of future weapon developments. First project in this office will be the anti-missile missile, a field in which both Army and USAF have projects.

Army partisans make no secret of their ambition to have Redstone Arsenal become a key contributor to projects carried out by the new single manager, and there are reports that they expect to "get the nod" from McElroy's appointee. After the anti-missile missile, the single manager will move into other areas, including space satellites.

Army spokesmen repeatedly claim that their Nike-Zeus, still in development, will be able to fully defend the U. S. against all enemy attack.

USAF Chief of Staff General Thomas D. White, on the other hand, says the Air Force Wizard, is still a "big problem." The Air Force chief says frankly there are some things "we don't quite know how to do."

Plato Continues

Plato, the Army-sponsored anti-missile missile study program being conducted by Sylvania, has acquired recent additional support. The program was scheduled for cancellation in the pre-Sputnik era.

Plato is aimed at producing a relatively mobile missile defense system to defend critical U. S. installations overseas from attack by Soviet intermediate range ballistic missiles. With an extended capability against shorter range missiles, Plato could provide battle area missile defense. Sylvania's contract is with Redstone Arsenal.

What U.S. Has Done Since Sputnik

Washington—Sputnik I, which publicly highlighted the Soviet Union's technological leadership, was put into orbit two months ago. Following is a chronological list of the steps announced by the U. S. since then:

- Navy triples funding for the Polaris fleet ballistic missile, awards Lockheed a $62.1 million contract to accelerate development (AW Oct. 28, p. 30).
- Project Farside, sponsored by Air Force Office of Scientific Research takes on new importance after being threatened by lack of funds. At least one and probably two of the rockets are believed to have reached the 4,000 mi. target altitude (AW Oct. 28, p. 31).
- Defense Secretary Neil McElroy revokes two economy orders of his predecessor, Charles E. Wilson, restoring basic research programs to the levels authorized by Congress and providing an additional $400 million to the military services—$300 million of this to USAF—for production and procurement (AW Nov. 4, p. 26; Nov. 11, p. 32).
- McElroy assures defense contractors Defense Department will pay its bills as they come due, canceling an earlier buy-now, pay-later approach that would have imposed severe financial burdens upon the aircraft industry (AW Nov. 4, p. 26).
- President Eisenhower names Dr. James Rhyne Killian, president of Massachusetts Institute of Technology, his special assistant for science and technology to oversee the U. S. science program (AW Nov. 18, p. 28).
- Secretary McElroy tells Army it can join in the satellite program by attempting to launch a vehicle with its Jupiter C three-stage research missile (AW Nov. 18, p. 27).
- Single manager for research and development on weapon systems is announced by Secretary McElroy, who says the anti-missile missile will be the new office's first project (AW Nov. 25, p. 26).

  The single manager has not yet been named.
- USAF Maj. Gen. Donald J. Keirn is named single manager for nuclear aircraft and nuclear propelled missile programs by Defense Department and Atomic Energy Commission (AW Nov. 25, p. 28).
- Both USAF Thor and Army Jupiter intermediate range ballistic missiles are ordered into production by Secretary McElroy, who says an IRBM operational capability can be achieved in the United Kingdom by the end of 1958 (AW Dec. 2, p. 26).
- Senate Preparedness Subcommittee headed by majority leader Lyndon Johnson (D.-Tex.) begins investigation of U. S. defense effort with emphasis upon America's lag in the ballistic missile field (AW Dec. 2, p. 31).

  Other congressional committees are making preliminary studies of the defense program.
- President Eisenhower orders Science Advisory Committee transferred from the Office of Defense Mobilization to the White House, adds five new members to the committee.
- Air Force transfers the 1st Missile Division to the Strategic Air Command from ARDC's Ballistic Missile Division, transfers the responsibility for the initial operational capability phase of both the ICBM and IRBM to SAC and orders that resources of San Bernardino, Calif., Air Materiel Area be used to support this effort.

New Funds Needed for IRBM Production

Washington—An emergency or supplemental appropriation of about $100 million is needed in this fiscal year to begin production of both the Army Jupiter and USAF-Douglas Thor intermediate range ballistic missiles.

A week after the go-ahead for production of both weapons was issued by Defense Secretary Neil H. McElroy (AW Dec. 2, p. 26), an AVIATION WEEK survey of the IRBM situation disclosed these facts:

- **Production rate has been fixed** with the clear intention of keeping the two programs parallel. It was reliably reported that the goal for the end of calendar 1958 is five Jupiters and six Thors per month.
- **There still is no clear-cut program** for control of the production program and no directives detailing how and by whom certain decisions will be made. Each service assumes it will continue work on its own version of the IRBM, although William M. Holaday, Defense Department director of guided missiles, has not made it clear how he will operate in the effort to deliver intermediate range ballistic missiles to Great Britain by the end of 1958.
- **Facilities now available at Douglas** Aircraft Co. are not going to be used to full capacity. The contractor will produce at the rate set by Holaday but is capable of producing at a much faster rate without relying on a second source (AW Dec. 2, p. 26).
- **Cost estimates per missile vary widely.** Figures suggested by one Pentagon expert indicate that the cost of a single Thor will be about $800,000, that of a Jupiter nearer to $1.8 million. This means that, for the price of six Thors and six Jupiters, the Defense Department could buy 18 Thors if a single item were in production.
- **No contract has been awarded** for the Jupiter. Army spokesmen assume Chrysler Corp. will make the missile at its plant in Detroit where the line for the Redstone missile is now operating. The company was reportedly confident that a production rate of five a month can be reached in 12 to 18 months.
- **In contrast to other estimates,** Army spokesmen say Jupiter will be cheaper than Thor. They argue that much of the development cost was absorbed in the Redstone missile project, that the final Jupiter will require less modification than the USAF counterpart and that the Army is more experienced in dealing with missile cost estimates.

It was clear from talking to military missile experts that the Defense Department decision to make both missiles was largely based on interservice political considerations and that it is not going to placate the rival camps.

In fact, there is a strong possibility it will foster further competition among the services.

USAF Chief of Staff Thomas D. White has said his branch of the armed forces has no time for bickering. Meanwhile, there is strong evidence that the Army has won support at high levels in the Defense Department.

One example is the fact that there are photographs available of the Douglas Thor production line in operation and they have been seen by properly-cleared military and civilian officials. They have not been released for outside publication on direct orders from Donald A. Quarles, Deputy Secretary of Defense and former Secretary of the Air Force.

The status of Jupiter has risen sharply since the time Charles E. Wilson, McElroy's predecessor, called a halt to Army funding for the project and in-

dicated that development would be continued only as a backup for the Air Force's Thor.

Holaday was reported to be "determined" that Jupiter be produced despite arguments on cost, speed of early production capability and the problems of separate training and ground equipment needed for each of the weapons.

Some of the equipment is common to both systems, particularly in the area of fuels. Both missiles use a North American Rocketdyne engine. On the other hand, there are a large number of test and ground equipment items that are peculiar to each missile, particularly among the "big pieces" used for ground handling, logistics, etc.

Overall, the cost of providing initial equipment of an intermediate range ballistic missile squadron in USAF will be about as high as that of a modern jet interceptor or bomber squadron. While the unit cost of the missile is considerably lower than that of the manned aircraft, support equipment charges are steep. It is impossible to use existing bases, fuel tanks, hangars and other items built for conventional airplane operations.

For the Thor, the Air Force has been working since the start of development on such key matters as logistic support (AW Aug. 26, p. 26). Top responsibility has been given to industry. Control of the program for the IRBMs has been given to the San Bernardino, Calif., depot of the Air Materiel Command.

Under construction at San Bernardino is a new electronic data processing center which will be connected by high-speed communications with all other AMC installations, industrial suppliers and the launching sites. The system will be in operation by mid-1958.

USAF also has been modifying Douglas C-133 transports as delivery vehicles for the Atlas and Titan intercontinental ballistic missiles.

Brig. Gen. B. I. Funk, AMC ballistic missile manager, is in charge of contracts for the Air Force on the Thor IRBM project.

New Grumman Contracts Exceed $86 Million

Navy awarded Grumman Aircraft Engineering Corp. two follow-on contracts for undisclosed numbers of WF-2 Tracer and F9F-8T Cougars totalling more than $86 million last week. Award for the Tracer twin-engine radar-warning plane totaled over $46 million and extends production on the W 2 into 1960; that for the Cougar totaled about $40 million and extends F9F-8T output into 1959.

New contracts would not necessitate increase of present work force, Grumman pointed out.

USAF Stakes Spacecraft Claim

Washington—Along with the assignment of its first ballistic missile responsibility to the Strategic Air Command, USAF also served notice that it considers the move part of an evolution to manned aircraft, missiles and spacecraft as a single instrument for performance of its mission.

Gen. Thomas D. White, USAF chief of staff, shifted the 1st Missile Division to SAC from the Ballistic Missile Division of the Air Research and Development Command. With it, SAC was given responsibility for initial operational capability of both the intercontinental and intermediate range ballistic missile programs.

Flexibility Essential

Acting within 48 hours of a Defense Department decision to start production of both the USAF Thor and Army Jupiter (AW Dec. 2, p. 26), Gen. White emphasized these points about the use of ballistic missiles:

- **Inflexibility** will be an inherent characteristic of the weapons, making it mandatory for USAF to have alternate delivery systems operational at all times.
- **Alternates** can be manned or unmanned and can operate in the atmosphere or beyond it. USAF will use the best tool for the job.
- **USAF looks upon** all three systems—airplanes, missiles and space ships—as "compatible and complimentary" and parts of a "functionally complete system."

Both the Army and Navy can use missiles to perform their missions, Gen. White said, but only USAF can wed them both to planes and to spacecraft.

Factors limiting the use of ICBMs, Gen. White told the National Press Club, include the requirement for precise data on the location of the target and its relation geographically to the launching site.

In addition, he said, there is the inability to recall an intercontinental ballistic missile or divert it to another target once it is launched.

For this reason, he said, the Strategic Air Command must be able to realign its attack when target values or the enemy's defense call for a change in tactics or strategy.

Gen. White's shift of the 1st Missile Division to SAC, the using command, will clear some roadblocks for both prime and sub-system contractors involved in missile system provisioning. The contractors in the past have been more or less forbidden to communicate with SAC except through Air Research and Development Command.

Operational Capability

The move is expected to speed development of operational capability, although the 1st Missile Division already has been organized for training at Cooke AFB, Lompoc, Calif.

Gen. White also confirmed that the San Bernardino, Calif., Air Materiel Area will provide logistic support for the ballistic missile operations. (AW Aug. 19, p. 26). In USAF terminology, this means the San Bernardino AMA is appointed weapon system Support Manager (WSSM) for all ballistic missiles. It will control the flow of spares

Gen. Gavin Stresses Space

New York—Control of space, including outer space, is the price of survival for the U. S., Lt. Gen. James M. Gavin, Army Chief of Research and Development, said last week. Agreeing with a statement made recently by Dr. Edward Teller, he said that the nation that controls space will control the future of the human race.

Speaking at the Annual Preparedness Meeting of the American Ordnance Assn. here which had as its topic "Limited Warfare," he warned that the nation must face the threat of forceful expansion by the Communists, probably by a series of "limited wars" because total war with its catastrophic destruction on each side would not serve Soviet purposes.

Because control of space, including outer space, is a prerequisite to the control of land, Soviet progress in ICBMs and the launching of satellites have indicated a shift in military power, he warned. In the future, additional satellites will be launched soon, with a military reconnaissance capability. This capacity, matched to an ICBM inventory, he said, will bring us to an era of hair-trigger existence in which, under a canopy of fear, the U.S.S.R. may attempt to expand its periphery.

Gen. Gavin stressed that an effective air defense is an essential element in the ability of the country to wage a limited war. He said that for specific areas such as a municipal area, an industrial complex, or SAC base, 100% effective air defense is possible.

In the nuclear-missile era he said, when a nation elects to defend a specific site it could provide an air defense so effective that it would not be worth the cost to an attacker to make a direct attack upon it. This he termed a 100% effective defense.

and maintenance facilities with the exception of power plants and warheads.

Other points made by Gen. White:

- **USAF is determined to improve** its warning and control system to facilitate defense against enemy missile attack.
- **Least desirable air defense,** a "last ditch" effort, is to fight the enemy after he gets over the target area. The Air Force aim is to keep the enemy from getting off the ground.
- **USAF is determined to win** the capability to control space, because it will result in control of the Earth's surface.
- **Gen. White** does not concede that Russia can destroy SAC bases in Europe with its IRBM.
- **Anti-missile missile** problems call for a major technological effort and there are some things "we don't quite know how to do."

Ramo-Wooldridge Lab Separates Functions

Los Angeles—Recent action of Ramo-Wooldridge Corp. in setting up new Space Technology Laboratories (AW Dec. 2, p. 25) is an organizational change intended to separate further the company's Air Force ballistic missile systems engineering functions from its growing defense and industrial electronics activities, according to Dr. Dean Wooldridge, company president.

Space Technology Laboratories will devote their full efforts to USAF ballistic missile program technical guidance, a responsibility previously assigned to Ramo-Wooldridge's guided missile research division. Dr. Simon Ramo, who has devoted the majority of his time to the ballistic missile program, relinquishes his duties as executive vice president and secretary of the parent corporation to become president of the new laboratories. Dr. Louis G. Dunn moves over to the new division to become executive vice president and general manager, while Dr. Ruben F. Mettler becomes vice president and assistant general manager.

New laboratories will have their own administrative and technical supporting facilities, instead of sharing them with the parent company as in the past, Dr. Wooldridge says. Company personnel previously assigned to the USAF ballistic missile program will be transferred to the new division.

Contrary to industry speculation, the newly created division does not alter announced Ramo-Wooldridge policy not to seek missile prime contracts, Dr. Wooldridge says. Nor does it alter basic ground rules established when the company took over ballistic missile technical guidance responsibilities which exclude the firm from manufacturing systems or equipment for any of the USAF ballistic missiles.

USAF Full Pressure Space Suit Is Light, Permits Free Movement

Washington—Breakthrough in pressure suit development has for the first time given USAF a practical full pressure suit capable of protecting man in both high altitude and space flight. One version will be worn by Scott Crossfield for his flights in the X-15 rocket research aircraft.

Breakthrough is successful development by David Clark Co. of Worcester, Mass. and Air Research and Development Command of a "slip-knit" nylon fabric which forms a pressure "capsule" but still allows the pilot great freedom of movement and relative comfort.

Cost of this portion of a 10-year USAF-Navy pressure suit program is $200,000 to $250,000. Work on this version has been under way for about 2½ years and the X-15 suit is one of four similar prototypes.

Suit can be donned by the pilot himself in 12 minutes. He needs help with his helmet but the goal for operational models is faster donning time plus a helmet that can be handled by one man.

Five-layer suit weighs about 13 lb. and a new back pack containing emergency oxygen and pressure system weighs approximately 11 lb. Brig. Gen. Don Flickinger, director of human factors at the ARDC headquarters, called both the suit and the pack "important, major breakthroughs" in suit development.

Previous full pressure suits have weighed closer to 100 lb. and have contained as many as nine metal slip-rings at body joints to allow limited freedom of movement. New suit incorporates only one slip-ring between the top of the suit and the helmet. This is the suit's only point of metal-to-metal contact.

Suit has been given blast pressure and impact force tests on rocket sleds and has been altitude tested to 175,000 ft., the upper limit of Wright Air Development Center's chamber. Heat tests have been run to 170F and wind tunnel tests have been made up to 650 kt. at sea level pressure.

Five layers are lightweight long underwear to insulate against extreme cold; ventilating garment through which air is pumped to cool the pilot; anti-gravity suit; the slip-knit or "fishnet" garment together with the pressure container, which is impervious nylon, and an aluminized outer garment to protect the fishnet against snagging and protect from heat.

Equivalent pressure inside the suit is 25,000 ft. Crossfield will fly the USAF-North American Aviation, Inc., research plane at speeds in the Mach 5-7 range and at altitudes to or above 250,000 ft.

Gen. Flickinger said that the suits in the group now nearing completion of development, including the X-15 suit itself, are fully capable of use in space flight.

SCOTT CROSSFIELD, NAA pilot who will fly the X-15, models USAF's new lightweight full pressure suit. New slip-knit nylon fabric allowed development breakthrough.

American Rocket Society Meeting:

U. S. Scientists Fear Makeshifts in Space

New York—Feeling that U. S. may jeopardize its future by attempting to match Russian space achievements over the next three years with makeshift measures dominated the American Rocket Society's 12th annual meeting here last week. Only a long range, comprehensive program will meet the continuing challenge of space, delegates felt.

American Rocket Society has formally proposed to the White House a national space flight program encompassing scientific, psychological and economic implications, and has proposed creation of an independent agency to handle all except the military aspects.

The American Rocket Society proposal, written before Sputnik I was launched, is intended as a mature analysis of the scope of effort necessary to insure eventual leadership in the conquest of space.

Society's Fear

Broadest implication of the proposal is that its authors, who represent a wide range of weapons development scientists, feel the government does not yet appreciate the present situation or recognize the threats and promises of the future.

Of more direct and practical concern to society members was the fear that their next few years might be spent in hammering together stop-gap vehicles aimed at duplicating immediate Russian achievements rather than working on projects with more military and civilian potential.

These policy themes completely overshadowed panel meetings and individual papers covering technical aspects of space flight that would have been of much greater interest four months ago.

Copies were sent to the White House eight weeks ago with a covering letter from Cmdr. Robert C. Truax, outgoing president of the society and deputy director of USAF's Ballistic Missile Division in charge Pied Piper reconnaissance satellite (AW Oct. 14, p. 26).

Copies also went to Dr. James R. Killian, Jr., President Eisenhower's science adviser; the President's Scientific Advisory Committee; National Security Council; State and Defense Departments; Central Intelligence Agency; National Science Foundation; Senate Preparedness Investigating Subcommittee, and a half dozen other government agencies or officials.

Commander Truax said no official reaction to the American Rocket Society proposal has been expressed yet, but unofficially the Society has had indications that Washington considers its plan "by far the most complete, comprehensive and well-founded" that has been offered so far.

Most others have been for individual projects or series of projects.

Considered Conservative

The Society's plan, calling for manned satellites and instrumented flight as far out as Venus and Mars over a 20-to-25 yr. period, is considered even by some of its authors to be conservative in the light of present capabilities and what Krafft Ehricke called a number of close-at-hand breakthroughs in pertinent technical areas. Ehricke is chief of preliminary design for Convair's Astronautics Division and chairman of the Society's Space Flight Technical Committee, which wrote the proposal.

Other committee members are Karel J. Bossart, Convair Astronautics; George H. Clement, Rand Corp.; Maj. George D. Colchagoff, headquarters, Air Research and Development Command; Col. William O. Davis, Wright Air Development Center, ARDC; Frederick C. Durant, Avco Manufacturing

NUCLEAR powered space ship proposed by Krafft Ehricke of Convair's Astronautics Division has the crew's compartments separated from the propulsion unit by a 100 ft. shaft. Atomic pile would heat liquid hydrogen contained in the tanks clustered just above the rocket nozzle. Very high specific impulse would be achieved using liquid hydrogen and the total energy produced by the engine raised considerably above that for a system using today's chemical propellants. A modified version of the craft would be able to use a very high energy trajectory to travel from the Earth to Mars and back in about 350 days. Trip time using the minimum energy trajectory would be over 900 days.

Corp.; Andrew G. Haley, Washington attorney; Richard W. Porter, General Electric Co.; Darrell C. Romick, Goodyear Aircraft Corp.; Milton W. Rosen, Project Vanguard technical director, Naval Research Laboratory; Alexander Satin, Lockheed Aircraft Corp.; S. Fred Singer, University of Maryland; Kurt R. Stehling, Project Vanguard propulsion chief, Naval Research Laboratory; Hubertus Strughold, Randolph AFB; and Wernher von Braun, Army Ballistic Missile Agency.

There were indications that Atomic Energy Commission's interest in nuclear rockets and ramjets (AW Aug. 19, p. 27) is for space flight application rather than flight within the atmosphere. Both Rocketdyne Division of North American Aviation, Inc., and Lockheed Aircraft Corp. are known to be involved in nuclear rocket work.

Single Manager Scored

Society officials privately expressed skepticism over the Defense Department's new office of single manager for anti-missile work and space flight programs.

In his letter to the President, Cmdr. Truax said a national program and an independent agency would "insure the eventual superiority of the U. S. in the new field. Our society feels that any less forthright action will not be adequate to overtake the Russian lead."

Truax also said the American Rocket Society has set up a file of 700 names of "top people in the business who have volunteered to work free of charge on problems we might assign out" until an agency is created. He said the American Rocket Society plan can be carried out without interfering in any way with military operations, chiefly through the kind of cooperation with the services and independent status that Atomic Energy Commission and National Advisory Committee for Aeronautics employ.

The agency would be called something like Astronautical Research and Development Agency (ARDA), with cognizance over all except strictly military projects.

Astronautical Research and Development Agency would serve basically as a management organization and contract to industry as much as possible. It would develop equipment, conduct explorations and evaluate information. Where necessary it might maintain small research laboratories.

Agency Makeup

This agency would include representatives from the general public and the scientific community, and from Defense, State and Commerce Departments and the Central Intelligence Agency.

American Rocket Society also proposed a conservative 25-yr. space probing plan including, in this order, satellites of up to a ton; instrumented rockets to explore moon-earth space and the moon; instrumented artificial comets to explore as far as Venus and Mars; manned hypersonic gliders; small inhabitable satellites for 4 to 10 persons, and manned lunar operations, including landing on the moon.

The first three steps could be accomplished by 1970 and the last three by 1983.

Predictions were based on present state of the art in missilery, communications, etc.

Most proposals put forward since Oct. 4 telescope this timetable to as little as 10 years.

Democratic Leaders Attack Administration Sputnik Reaction

Washington – Democratic congressional leaders last week attacked the public assurances of confidence and the mild reactions of the Eisenhower Administration in facing up to Russia's satellite-missile accomplishments. They will become even more vocal in the months ahead when Congress reconvenes.

After a bipartisan White House session of 31 Democratic and Republican congressional leaders on legislative needs last week, Sen. Lyndon Johnson (D.-Tex.), Senate majority leader, commented: "They need a greater dose of urgency."

The chairman of the House Appropriations Committee, Rep. Clarence Cannon (D-Mo.), complained: "The danger confronting the U. S. and the disastrous defeat suffered (Russian satellite launchings) were mentioned only incidentally" at the conference.

Defense Expenditures

The administration did propose to the congressional leaders that Fiscal 1959 defense expenditures be $40 billion, $2 billion over the "firm" $38 billion expenditure ceiling originally set for Fiscal 1958.

Actually, new spending under this plan would be slight. Defense expenditures during the first four months of Fiscal 1958 were $13 billion, a rate of $39 billion for the year.

The White House session followed assurances on U. S. defense strength by Deputy Secretary of Defense Donald A. Quarles in testimony before the Senate Preparedness Investigating Subcommittee headed by Johnson. He told the subcommittee:

"Taking the missile program as a whole and comparing their (Russian) program with our own, I estimate that as of today our program is ahead."

Quarles Confident

Cautioning that "we might be in danger of creating a world impression that our weak points are weaker than they actually are," Quarles added:

- **Long-range missile program.** "As of this time, our program either is on a par with theirs or the differences are such that, viewed by and large and taking everything into account, one would find it very hard to say which program is ahead." He said the chiefs of staff of the three services would concur in his statement.
- **Electronics.** "We are ahead of Russia today in military electronics, taking it as a whole."
- **Rocket engines.** "They have one that is more powerful as an individual engine than any we have . . . (but) one would be even there cautious about the statement that they were ahead of us in rocket engines."
- **Jet engines.** "They have individual jet engines that have greater thrust . . . (but this) does not by any means speak for the overall quality."

Johnson's Reaction

Johnson, perturbed at Quarles' complacency, retorted:

"The net of it is that the American people can have adequate defense and eat their cake too—and even have whipped cream on it."

Quarles reported that, except for missiles programs, there has been no change ordered in the tempo of production of any other military items.

Quarles said that, with the benefit of hindsight, the satellite development program should have been given to the Army's Redstone Arsenal in 1955, rather than to the Navy. At the time, he concurred in placing it with Navy. Had the program been given to Army, Quarles said, "very possibly" the U.S.

Boron Fuel Reported

Boron base high energy fuel in solid form was reported last week by the Callery Chemical Co. Laboratory experiments on a small scale have been successful and the company hopes to have enough of the fuel on hand within a year to start a test program with full-scale engines. Callery has financed the project completely with military sales planned if the development is successful. Lithium perchlorate is one of the oxidizers receiving close attention for use with the boron fuel.

would have launched a satellite months ahead of Russia's Oct. 4 Sputnik I.

Preceding Quarles in testimony before the subcommittee, Secretary of Defense Neil H. McElroy, in addition to announcing the decision to produce both Army's Jupiter and USAF's Thor missiles (AW Dec. 2, p. 26), said he believes these things should be done:

- **Strengthen retaliatory forces** by increasing the speed of response for Strategic Air Command and Navy carrier planes and through further dispersal of SAC.
- **"Invest in improved detection** devices for new types of weapons about to face us some months down the road."
- **"Move forward rapidly" on** anti-missile missiles.
- **"Pursue an active program** in various satellite fields, which we have been exploring and some of which seem to have very definite and specific interest for the country."
- **Speed deployment of** ballistic missiles, including Navy's ship and submarine based Polaris. This deployment is "urgently important now," he said.
- **"Move right along in** the testing program" for Convair's Atlas intercontinental ballistic missile and continue to push Martin's Titan ICBM.
- **"Pursue the subject** of improving capability of our ground forces," the Army and the Marine Corps.
- **Continue research** and development on advanced weapons.

At the subcommittee's request, McElroy said he will study:

- **Incentives and penalties** for contractors, especially in the missile field. McElroy testified that this problem is under continual study by experts, and so far no better contracting system has been devised.
- **Testimony of Dr. John P. Hagen,** director of Project Vanguard, that he formally requested higher priority for the satellite work in 1955 but got no action on it. McElroy said he was told the request never reached the Defense Department.

AIA Gets Budget Cut; Dues Structure Altered

Phoenix, Ariz.—Aircraft Industries Assn.'s board of governors has slashed approximately $200,000 from the association's proposed 1958 budget, cutting the total figure to about $1.3 million. At the same time, the board lowered the maximum dues charged to its largest members and boosted minimum dues charged to smaller firms.

The maximum annual dues were lowered by the board from the previous $105,000 to a top of $75,000; minimum dues were raised from a low of $300 to $1,500. After learning of the boost in minimum dues, representatives of several smaller firms at the board's meeting here said they would recommend that their companies resign from AIA rather than pay the higher rate.

An AIA spokesman said the change in the dues structure was decided upon because it was felt the larger firms were paying a disproportionate share of the association's budget.

Most of the $200,000 budget cut will be felt by AIA's public relations activities, which are operated for the association by Hill & Knowlton in Washington. Some staff reduction and a curtailment in public relations activity will be complete by January.

Board members also are considering a change in the association's name that would make reference to both aircraft and missiles. A total of 27 prime missile contractors are AIA members.

In other action, George M. Bunker, president and board chairman of the Martin Co., Baltimore, was elected chairman of the AIA board of governors for 1958.

Bunker will be the first AIA chairman to serve for a full year, all his predecessors having been elected for six-month terms. He replaces Whitley C. Collins, president of Northrop Aircraft Inc., Hawthorne, Calif.

AIA's governors also re-elected DeWitt C. Ramsey, vice chairman; Orval R. Cook, president; Leland D. Webb, vice president and Western Region manager, and Harrison Brand, Jr., secretary-treasurer.

C. J. McCarthy, chairman of Chance Vought Aircraft Inc., Dallas, was elected to a vice presidency.

Flying Atar Launcher?

Flying intermediate range ballistic missile launchers have been proposed by Prof. Theodore von Karman to eliminate the tactical disadvantage of using relatively vulnerable fixed launching sites. Prof. von Karman's suggestions were made to Snecma, the French aircraft firm. He believes that Snecma's Flying Atar could be developed into a multiple powerplant, airborne launching vehicle for a large solid propellant rocket with IRBM range.

Swiss Government Initiates Order For 100 Home-Built P.16 Fighters

By David A. Anderton

Geneva—Swiss government has approved in principle the purchase of 100 Swiss-designed and built FFA P. 16 ground-support fighters as the second step in re-equipping the Flugwaffe.

First step was the purchase request for 100 Hawker Hunters (AW Nov. 25, p. 27) for ground support. Total funding to be approved for that purchase is about $74 million, including spares and engines. Amount of the P. 16 order has not been disclosed.

Final approval for both orders is expected at the end of this month's session of the Swiss Parliament.

Many airmen here believe the Swiss still need a third type of fighter to provide top cover for the Hunters and P. 16s when they perform their ground-attack missions.

Neither of those airplanes has a rate of climb that can qualify them as contemporary interceptors for a country the size of Switzerland. For that reason, French and American sales teams are continuing their efforts to sell the Swiss a supersonic interceptor.

Observers here see the P. 16 order as a quick action to stifle protests of the Swiss aircraft builders and their associated industrial complex to the outside purchase of Hunters. Less than one year ago an order for 40 French-built Dassault Mystere 4s was in the process of being approved when it was suddenly rejected in favor of voting an additional $10 million to the development of the P. 16.

So far the P. 16 program has accounted for about $15 million, spent on the design, development and construction of six prototypes. Only two of these airplanes are now flying, three are still under construction and one was lost with its pilot on a test flight.

Some Swiss sources report that this country is not equipped to turn out the P. 16 or any other new airplane at a reasonable cost. They say that no other country of the size and resources of Switzerland has even tried to develop a postwar air arm of its own, but has instead turned to foreign purchase.

They point out that the "buy-Swiss" advocates of the P. 16 seem to overlook the fact that the airplane is powered by a British engine, the Armstrong-Siddeley Sapphire. Necessarily, a major portion of the funds voted for the P. 16 would therefore go out of the country.

Final flight trials of the handful of contenders for the Swiss order narrowed the choice down to the Hunter and the P. 16. Both these airplanes were tested by a group of six Swiss pilots on comparative missions. They were demonstrated in armament firecouts to a military committee of the federal government. Their mission capabilities were compared to the performance of the de

Havilland Venom fighter-bombers now arming part of the Swiss Flugwaffe.

Swiss say the P. 16 carries heavier armament and has about 50% more fuel capacity than the Hunter. In addition, the plane has a slower approach and landing speed. The P. 16 is also called a more stable gun platform.

But with all these cited advantages, the P. 16 costs much more than the Hunter, and will not be available at the same time. The realistic view is that the P. 16 will be some months behind.

Swiss commissions have been considering these purchases for months and have made window-shopping tours of other countries looking at foreign airplanes. They showed interest in several U.S. fighters, which might have been available at the right price to the Swiss. But NATO countries have first call on military aircraft exports from the U.S., and the Swiss saw no point in further discussions.

Delays in the decision-making machinery here have already cost the Swiss about one year in delivery times. Had they selected the Hunters earlier this year, when the issue was first raised, they would have had production-line priority of position over the Indian order.

Chance Vought Wins USAF Alloys Contract

Dallas—Chance Vought Aircraft Inc. has won a $1,093,854 Air Force contract calling for development of techniques for casting high strength steel alloys needed for aircraft in speed ranges above Mach 2.

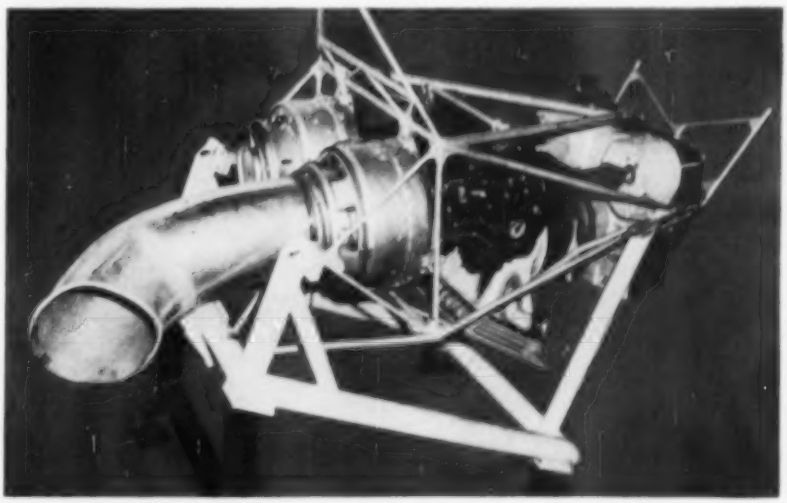
Contract awarded by Air Materiel Command makes Chance Vought the prime contractor in a two-year program. Company will choose three foundries to share development work, and findings will be available to all foundries making castings for military aircraft.

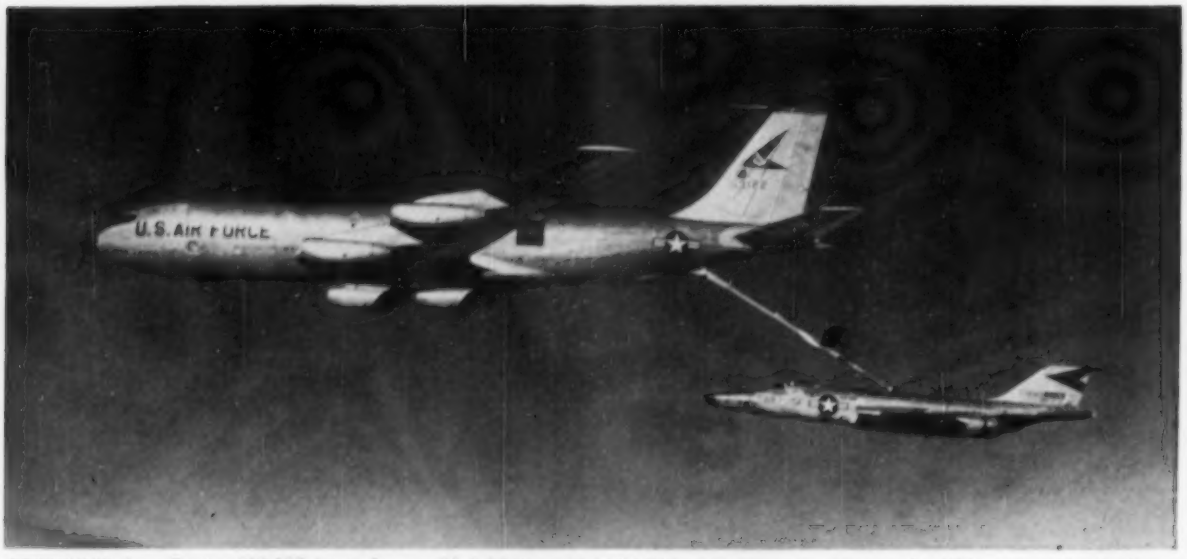
After three foundries have been chosen to do the actual development work on parts designed by Chance Vought, the program will move into a laboratory test phase. Here, tests will be made to select steel alloys that can be stressed to 180,000-220,000 lb. per sq. in., and methods developed to make them castable. Ultimate goal of the program is to produce usable castings that can develop tensile strength of 260,000-300,000 psi.

Actual parts will then be designed by Chance Vought to be cast by the three foundries selected. The program will move on with the trial production of a contoured part in larger lots to determine whether it can be produced in quantity, and final phase will be pilot production of selected castings in quantities large enough to establish consistent results.

Vertol Tests T58, T53

Vertol Aircraft Corp. is demonstrating two twin-turbine-powered helicopters, offering a choice of General Electric's T58 (above) or Lycoming's T53 (below) installations. Either power package can be provided in a retrofit kit for Army or USAF use in the Vertol H-21. No commercial H-21s are in operation, but the company is offering its certificated version, the Vertol 44, to corporate and airline users. T58 installation was made in an Army H-21D and developed under contract for the Army and Navy's Bureau of Aeronautics. It has been flying since September. The engines are in a tandem arrangement. Lycoming's T53 was placed in a helicopter called the Vertol 105, with two engines located side-by-side, and flown less than a month ago. The aircraft was developed by the company with the Army providing the engines. Vertol says replacement of the H-21's normal Wright R1820 reciprocating engine by two turbines results in a 40% increase in payload, plus a gain of 50 mph. in additional speed.





REFUELING from Boeing KC-135 jet tankers enabled McDonnell RF-101Cs to set cross country records. This is a practice hookup.

Jet Tankers Add Margin in Speed Dash

By Erwin J. Bulban

New York—Air Force's improved air-to-air refueling capability provided by its new jet-powered Boeing KC-135A Stratotankers was demonstrated in recent cross-country speed dashes by four Tactical Air Command RF-101C Voodoos, which took three records away from Navy in a single day.

Pilots from the 17th and 18th Tactical Reconnaissance Squadrons, 363rd Tactical Reconnaissance Wing, Shaw AFB, N. C., broke previous Navy marks by these approximate margins: west to east they lopped some 20 min. from record set last summer by Maj. John Glenn, Jr., in a Chance Vought F8U-1P Crusader; on the east to west and roundtrip portions of their flights they chopped two hours and three hours, respectively from previous mark set by a twin-jet Douglas A3D Skywarrior attack bomber.

Maximum Afterburner

Like Maj. Glenn, the Voodoo pilots made maximum use of afterburners on their P&W J57-P-13-equipped Voodoos; one pilot told AVIATION WEEK that at times he exceeded 1,100 mph., but added that this was not "nearly" the maximum speed of the airplane.

Air-to-air refuelings presented no problem, he noted, despite the fact that the fighter-reconnaissance pilots were introduced to the Strategic Air Command KC-135As for the first time when they went to the West Coast to prepare for their flight. Comparing the KC-135A with piston-powered Boeing KC-97 and KB-50 tankers, the pilot pointed out that hookups were made at approximately 35,000 ft., with tanker's ground speed being 520 mph. He noted that when using the piston-powered tankers, usual operation was to descend to 15,000 ft.-20,000 ft. Tankers could only get to about 220 kt. speed, posing real problems to high-speed fighters.

CLOSEUP shows RF-101 flown by Capt. Ray Schrecengost refueling over Allentown, Pa.

Two Waves

Air Force sent the Voodoos off from Ontario, Calif., in two waves of three planes each, each plane taking off approximately five minutes apart and waves spaced about 40 minutes apart. Two of the airplanes were spares, in case some had to drop out; extra planes returned at the first fuel contact, which was approximately 400 mi. from takeoff. Air Force has not disclosed the number and location of tanker planes.

Each of the planes flew the same VFR flight pattern, which was the reason for takeoff spacing. Air Defense Command ground radars provided pilots with individual guidance for navigation. Planes climbed to 45,000 ft. after takeoff, flew between 45,000 and 48,000 ft. during the flight except for descents to refuel.

Pilots used charts to check fuel and distance: plan was to allow a 2,200 lb.

SUPERSONIC SCORE KEEPER—Seek-and-kill power of United States air defense weapons of the future will be tested by modern aerial target systems like the supersonic USAF XQ-4 developed by Radioplane Division of Northrop Aircraft, Inc. The XQ-4 can duplicate the performance of a modern high-altitude bomber or missile. Latest of a long series of Radioplane aerial target systems, it tallies up the score of theoretical hits and near misses and is recovered by parachute for repeated use. Today, other Northrop divisions are building the first intercontinental guided missile, the USAF Snark SM-62; the revolutionary supersonic twin-jet USAF T-38, first of an entirely new family of light-weight, low-cost aircraft; and the new low-altitude ground-to-air missile, U.S. Army Hawk, with Raytheon Manufacturing Company. Advanced Northrop engineering and production techniques will continue to lead the aircraft and missile industry in providing low-cost solutions to defense problems.

NORTHROP

NORTHROP AIRCRAFT, INC. • BEVERLY HILLS, CALIFORNIA

Builders of the First Intercontinental Guided Missile

Photo by Halsema

first . . . *plane to land at the South Pole*

place . . . *Operation Deepfreeze II*

heater . . . *Herman Nelson, of course*

The first aircraft ever to land at the South Pole—and the first Americans to set foot at the South Pole . . . these were history-making feats achieved by Operation Deepfreeze II. The mission was carried out on October 31, 1956, by a party and crew of seven men in this Navy R4D. Naturally, Herman Nelson Portable Heaters were chosen as support equipment for this important mission, providing quick, unfailing heat. Herman Nelson's 16 years of experience in the portable heating and ventilating field can be put to work on your problem.

American Air Filter COMPANY, INC., LOUISVILLE, KENTUCKY
DEFENSE PRODUCTS DIVISION

SERVING THE DEFENSE ESTABLISHMENT EVERYWHERE

fuel reserve at each fueling point, which would give them alternate of some 150 mi. to the nearest airport with reserve of five minutes over the field.

Voodoos covered some 100 mi. in following the tanker in refueling; procedure was to hook up and fuel for about 50 mi., unhook and fly with the tanker, then hook up again to top off the tanks. Run took about 10-12 min.

Speed run was handicapped some by a rise in predicted temperature, which limited speed, during the first half of the trip. Flight planning was predicated on temperature at 45,000 ft. being approximately −56C; during the flight pilots encountered temperatures of approximately 49-50C. From Kansas City to New York, temperatures went down to near those planned and pilots were able to pick up speed.

Last refuel was made about 150-175 mi. from New York, and here there was a slight mixup that cost the one-way pilots a few precious minutes, AVIATION WEEK was told. Plan was that the fastest men across would only take enough fuel to get to New York with reserve to permit maximum speed dash in final lap; inadvertently all four airplanes were topped off. Thus, fastest man across landed at McGuire AFB, N. J., after passing over the Floyd Bennett NAS tower for FAI calibration, with approximately 9,600 lb. of fuel left.

All planes carried a full complement of reconnaissance cameras to simulate an actual mission.

Record-breaking flight of the F-101C Voodoos marked the first mission-type use of their battery of Fairchild and Hycon aerial cameras in Century series type aircraft.

Day reconnaissance cameras carried by the planes were:

- **One Fairchild KA-2/12 in.** focal length forward firing unit mounted obliquely to point 15 deg. below the horizontal; uses 9 x 9 in. film.
- **Three Fairchild KA-2/6 in.** focal length units mounted in a standard trimetrogen arrangement to cover 180 deg. horizon-to-horizon with 10 deg. extension on each side to give a full 200 deg. coverage. Units also use 9 x 9 in. film.
- **Two Fairchild KA-1/36 in.** focal length split vertical (slightly off vertical) aft cameras which use 9 x 18 in. film.

Night reconnaissance equipment is the same as the day except that the three Fairchild KA-2 trimetrogen cameras are replaced with three Hycon K-46 units in the same configuration; K-46 cameras use 5 x 5 in. film.

Night configuration also includes four 7B or 8A flare ejectors.

Exposure control system used on the Voodoos is SCCS (Simplified Camera Control System) which is a simplified outgrowth of UCCS (Universal Camera Control System) developed by Bill Jack Scientific Instrument Co. (AW Nov. 21, 1955 p. 41). SCCS was developed by Hycon Manufacturing Co. and Allen B. DuMont Laboratories, Los Angeles Branch.

The exposure control and image motion compensation portions of the SCCS were inoperative during the flight, but the intervalometer was working. Exposure and shutter speeds were hand set on the ground.

A Chicago Aerial Industries terrain light indicator was on each plane.

Two of the four aircraft used color film in the single forward firing KA-2 and two KA-1 aft cameras. However, pilot of one of the two planes did not turn on the color cameras and the other turned them on to runaway speed so that all 40 ft. of color film was exposed over Kansas with as much as a 95% overlap. However, some good color photographs were taken.

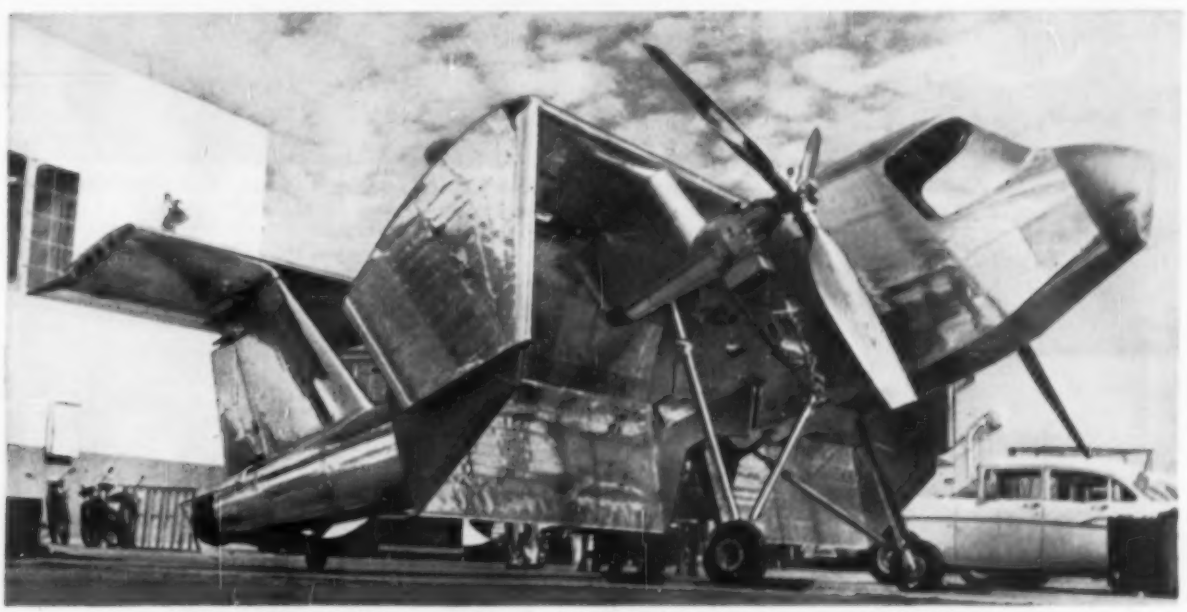
Two other F-101Cs used only black and white film. Because of vibration problems in the Voodoo, shutter speeds of 1/150th to 1/400th of a second were used with black-and-white film to reduce blurring possibilities. A minus blue filter was fitted over the lenses.

Color was shot at 1/150th and F.8.

W. G. Key Quits Fairchild For Nixon Press Chief Job

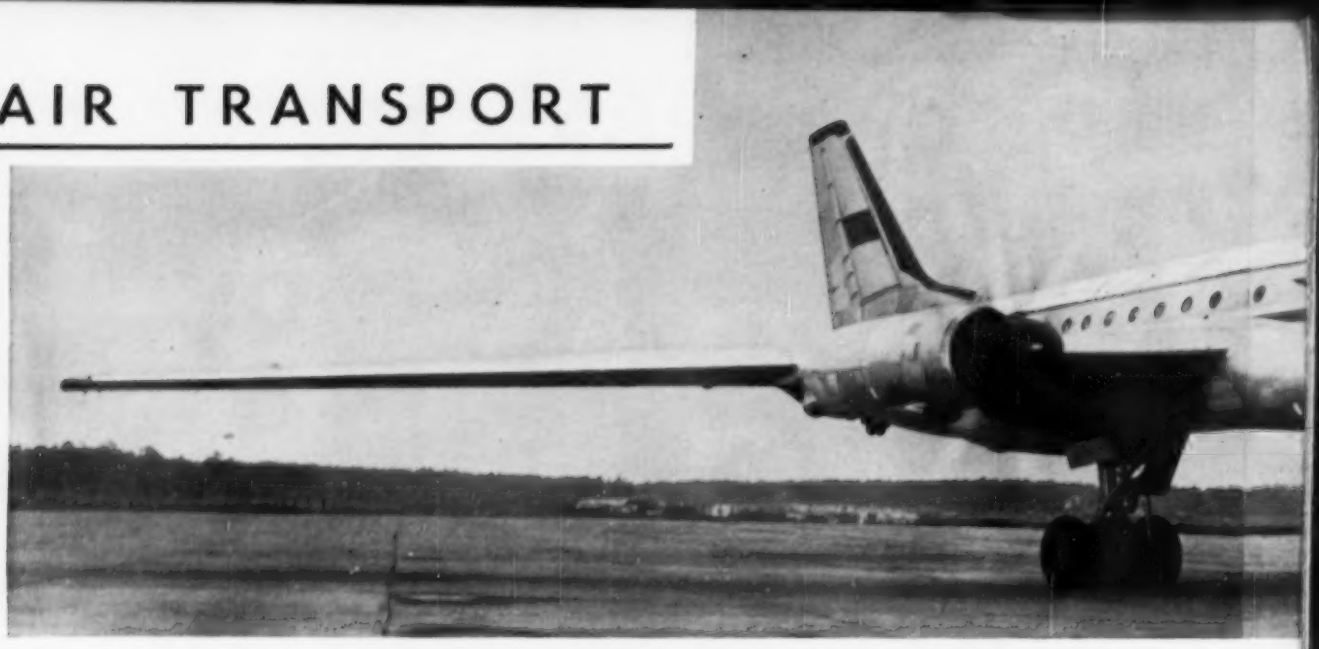
Washington—William G. Key, assistant to the president of Fairchild Engine & Airplane Corp., has been appointed press chief for Vice President Richard M. Nixon.

Key, 47, is resigning his position with the company to accept the Nixon post. He is a former city editor of the Atlanta Constitution and has served as assistant director of public relations for Capital Airlines.



First Photo Shows Ryan VTOL Vertiplane at Rollout

Ryan VTOL Vertiplane, powered by Lycoming T53 in fuselage, is shown at recent rollout. Double retractable wing flaps deflect propeller slipstream; end plates at wingtips confine slipstream to flap span. Two-seat aircraft is 27 ft. 8 in. long, 10 ft. 8 in. high, has 23 ft. 5 in. wingspan, gross weight of about 2,600 lb. Vertiplane was designed, built for Army under Office of Naval Research direction.



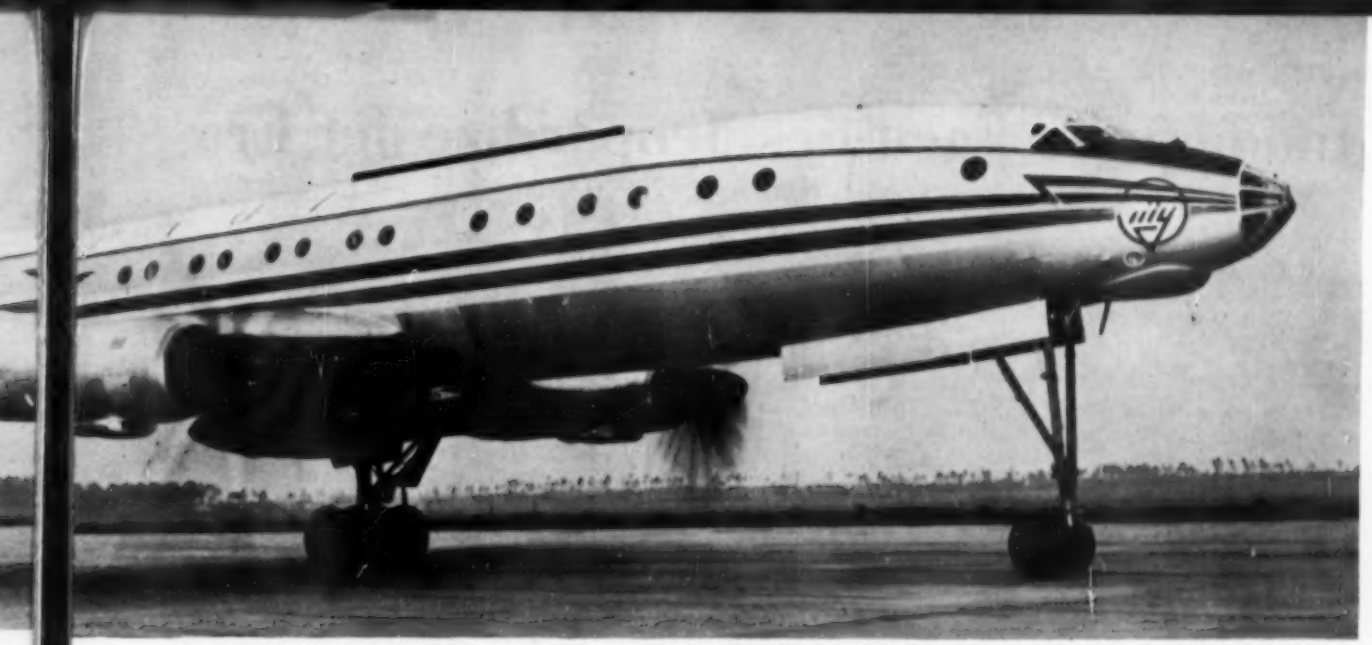
Russians Show Off Huge Tu-114 Transport

Smile of approval for Designer Andrei Tupolev, seated in the Tu-114, comes from Soviet Boss Khrushchev (left), . . .

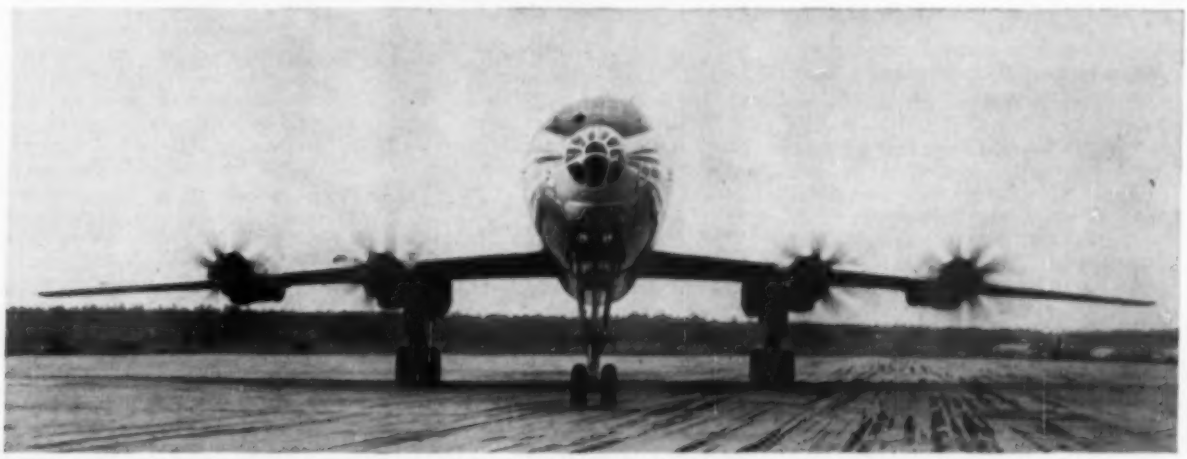
Chief Pilot A. Yakimov in cockpit. Note visors over instrument panel, control column layout, simple console.

. . . and Mao Tse-tung, Chinese Communist leader, also is posed with Tupolev prior to his departure from a Moscow visit.

Central of three passenger salons is restaurant type, seats 48 passengers. Forward seats 41, tail 54.



Russian Tu-114 airliner bears obvious resemblance to Bear bomber and its gross weight probably approximates that of Bear—330,000 lb. Powerplants are four 12,000 eshp. turboprops turning contrarotating propellers. Length and span also approximate that of Bear—150 and 180 ft. respectively. Main landing gear retracts rearward into long inboard nacelles.



Double deck fuselage carries passengers on upper level, has kitchen and baggage below. Long range version carries 120 passengers, medium range 170. On short ranges, such as the Moscow to Crimea stage, it can carry 220 passengers.

Passenger shaves in washroom.

Forward passenger compartment has six abreast seating. Three stewardesses are in crew.

Inadequate Facilities Jeopardize Jet Era

By Glenn Garrison

New York—Airline jet operations could fail completely without adequate ground equipment—practically none of which is in existence today, members of the American Society of Mechanical Engineers were told last week at their annual meeting here.

Jet age ground support needs offer a real challenge to airline managements and to the suppliers of equipment, F. C. Wiser, American Airlines assistant vice president-operations, advised the engineers.

From discussion by Wiser and other speakers at aviation sessions of the ASME meeting, it appeared that many unsolved ground problems remain with the airlines at the eleventh hour before their jet era. Bold new concepts must be applied to the handling of aircraft, passengers, baggage and cargo, but in general the challenge has not yet been met.

Airports Unprepared

"Not one airport in our system today where we're going to handle the Boeing 707 has an adequate terminal building or runways," Wiser said. Some suitable runways are planned but are several years in the future. Initially at least, American's jets will have to operate at less than maximum capacity or follow other less than ideal procedures, according to Wiser.

Taxiways are not wide enough to alleviate the problem of ingestion of foreign materials into jet engines, the American official said. Only Boston has adequate taxiways, and other airports where the 707 will operate have not even planned to widen their taxiways, according to Wiser.

The problem is recognized, there has been a lot of talk about it, "but nothing has been done," Wiser said.

Ground equipment needed for the jets includes larger towing vehicles with about 25,000 lb. draw bar pull compared with 12,000 lb. of today's tugs, Wiser said. Also needed are bigger external power units of 125 KVA per gate position, more suitable jet engine starting devices, fueling facilities to handle the great volumes of jet fuel.

In the aviation sessions covering terminal and ramp needs, noise problems, passenger service requirements and the shortcomings of cargo handling equipment, the engineers also heard:

• **H. J. Curtis** of Trans-Canada Air Lines call for streamlined ground operations by improved methods of materials handlings, use of more machine power and less manpower, reduction of the amount of portable equipment surrounding an aircraft on the ramp. Airlines and airport administrations have never had a better opportunity to integrate ground operations with terminal structures, Curtis pointed out. New aircraft will be operating into many new terminal buildings "and there has been time to plan the best foreseeable operation affecting both facilities."

To get the most out of jets, Curtis said, turnarounds will have to be treated like en route stops. TCA believes that taxiing will become the accepted practice for moving aircraft to and from runways, although other methods are under discussion. The conventional tractor will be the "work horse of the ground movers" as it is now, particularly in the inaugural period of jet operation.

Ramp maneuvering techniques must be re-appraised in the light of four new problems peculiar to jets: noise, blast, heat and fumes. While much research is being done on airborne sound suppressors to reduce takeoff noise, research on intake noise suppression is lagging, and this high frequency intake noise will be most annoying at the ramp. However, this noise is highly directional and can be deflected somewhat by barriers.

Ramp Noise

Ramp noise also can be adequately excluded from terminal buildings by keeping ramp windows closed, using improved door seals and placing air vents and intakes on opposite sides of buildings. Passengers boarding aircraft on ramps near moving aircraft "probably will have to get used to the noise." Blast is a serious problem which could be alleviated by using barriers, although they create additional problems such as congestion.

When operational frequencies are not heavy, monitoring aircraft movements might be a better solution to blast problems. Heat is not considered a major problem. Fumes, especially when kerosene is the jet fuel, will probably necessitate closed building areas facing ramps in large scale jet operations.

TCA is proposing and prototyping a self-mobile baggage conveyor that would offload DC-8 baggage onto three belts, drive to the claim area and dispose of the load on a mechanized delivery unit.

• **R. Boyd Ferris,** assistant to technical director, International Air Transport Assn. said in the application of sound principles to jet ground handling needs "you will get almost as many solutions as there are problems." Ferris pictured an ideal airport as international airlines would like to see it, including an air conditioned terminal building with sealed windows against noise, enclosed two-level fingers with covered bridge for second-level loading, conveyor system or pre-loaded containers for baggage. Fuel, electrical power, conditioned air and water would be supplied from connections to fixed facilities on the ramp.

• **Rudolph H. Tolson,** assistant manager, construction and equipment division, the Texas Co., discussed jet fueling requirements and reported that to date it has not been definitely established whether JP-4 type fuel or kerosene will be the major fuel used by commercial airlines.

• **Charles H. Dolson,** vice president-operations of Delta Air Lines, said quality of service to passengers will determine whether an airline gets its share of the expected traffic increase. Present service, he pointed out, leaves a great deal to be desired. Reservations handling has been poor, although electronic equipment promises a solution. Lack of flight information to passengers is a serious problem, and any solution is "quite nebulous" in view of the more difficult communications which will be required by jet-age expansions.

Mishandling and loss of baggage, a substantial financial and customer relations problem now, has "fantastic" chances for disrupting jet operations, Dolson said. New tools and procedures are needed in this area, but any mechanical equipment must be within the carriers' economic means. Of terminal building design, Dolson said there is no such thing as an ideal terminal because requirements differ at each airport. Generally, protection from weather and one-level operation are required. Use of passenger tunnels under ramps to loading positions should be re-studied as a possible answer to protection not only against weather but against noise and blast of jet engines.

Aircraft Servicing

Cabin cleaning and service of jets may be the key factor in determining turn-around time, Dolson said. It is doubtful if a big jet can be turned around in 1½ hr. using present techniques if full cabin servicing is required. The Delta official said he had even heard a proposal for an "inflight janitor," an attendant carried aboard a flight to keep up with cleaning requirements. One of his pet hates, Dolson said, is present galley location, which forces passengers in effect to walk through the kitchen and which interferes with loading. Equipment manufacturers usually brush this element aside, Dolson said. He suggested development of unitized pre-loaded galleys, and pointed out that on non-meal

flights, the galley space could be utilized for additional passengers.

Aircraft interior design must be improved for better passenger service, Dolson said. Among the items needing improvement are ash trays and seats.

• **Harold E. Gray,** executive vice president, Atlantic Division, Pan American World Airways, described his airline's planned overhang-roof terminal building at Idlewild Airport, pointing out that the Idlewild situation was unique in that each airline has its own individual facility. Two general considerations in terminal design, Gray said, are suiting a particular purpose and size. Thus, specialization of a building for passenger use and relative smallness of the building almost automatically make a good terminal.

Early Boarding

Pan American wants to allow its jet passengers to board their aircraft as early as they like before flight time when the plane is ready and on the ramp. The passengers can make themselves comfortable, perhaps have a drink or snack, and smoke while they await departure.

Gray said the airline has considered using buses between gate and airplane, as is done at London Airport, but discarded the idea in favor of the "umbrella" terminal design which he said first aroused his interest at Tempelhof.

• **H. O. Parrack,** technical director and coordinator research and development program, A. F. Noise and Vibration Control, Wright Air Development Center, said the Air Force spent $100 million fighting structural aircraft damage from noise in one series of military aircraft, which he would not identify. Parrack said much work remains to be done before civil jets will be entirely satisfactory to communities from a noise standpoint. Airport personnel in buildings near ramps can be protected against ramp noise by suitably designed structures, the scientist said, but the buildings won't come cheap.

Dr. Parrack said aircraft interior noise has been fairly well controlled, but he predicted greater problems in this area in future jet aircraft.

Community Study

• **P. N. Borsky,** study director, National Opinion Research Center, reported results of a five-year $200,000 study of community reactions to noise that his firm had conducted for the Air Force. Relating the findings of 2,300 interviews in homes near three Air Force bases, Borsky's statistics showed that the more noise and the longer exposure to noise is present, the more annoyance is created. Where knowledge of the base's importance and belief that base authorities are showing consideration is present, the annoyance tends to be less, Borsky reported. The firm's recommendation to the Air Force as a result of the study: more interviews at other bases.

• **L. R. Hackney,** of Air Logistics Corp. presented a plan for using various items of ground equipment in combination to reduce or eliminate ground noise. Items in this "systems approach" to jet noise include a moving and ground power vehicle, portable sound suppressor and mobile engine run-up and test system.

Cargo Handling

The ASME members heard three speakers point up the need for improvements in cargo handling techniques.

Developments in ground handling equipment must be coordinated with flight operations, maintenance and traffic functions of an airline, Arthur V. Norden, executive vice president of Seaboard and Western Airlines, pointed out.

This coordination has been lacking in the air freight industry, Norden said.

Seaboard and Western has been operating transatlantic freight service for 10 years, and during that time "not one manufacturer has come to us and attempted to show us how we could reduce our ground time with a view to developing equipment which would help us reduce time or save money," Norden said.

Ground handling and loading of cargo, the Seaboard and Western official said, is still in the pre-World War II era. His airline is still using the forklift side-loading of its Super Constellations that was used to load the C-47, C-46 and C-54.

With a true freight airplane still beyond the horizon, Norden said, the cargo carriers' only hope to expedite the great expected growth of their business is in ground handling equipment.

Col. Sam P. Triffy, chief, packing and handling division, USAF headquarters, called air freight operations "in sad shape" compared with other aviation fields in which great progress has been made.

Among the reasons for this condition, Triffy said, are too much emphasis on passenger operations and lack of an inexpensive cargo airplane to compete with surface carriers.

The officer described the changes in air cargo handling instituted at Dover AFB following a study by an Air Force management engineering team, which he said have effected a substantial improvement in warehousing, number of handlings and documentation.

He noted that the Air Force now considers air movement of freight a normal mode of transportation rather than a premium emergency service.

Glide-Aire

A proposed system of handling air cargo by floating pallets on a cushion of air was described by Paul L. Smith, chief of operations, analysis section, Douglas Aircraft Co. The system, called "Glide-Aire," consists of a specially constructed floor, or platen, used with a special cargo pallet. Ball valves in the platen release air when the smooth surface of the pallet passes over them, reducing the force necessary to move the pallet and permitting omnidirectional movement. The floors would be installed in aircraft and/or ramps to the plane.

Republic Proposes Transport

Short to medium range four-engine turboprop transport featuring good short field take off and landing performance is being proposed to the airline industry by Republic Aviation Corp.

Plane's name, Rainbow, was borrowed from the company's XR-12 long range photo-reconnaissance plane. Two of them were built and flown in 1946 and 1947. New plane resembles the XR-12 with its pointed nose and cylindrical fuselage. Short take off and landing performance is achieved with the help of large, slotted Fowler flaps and leading edge slats.

Some details of the airplane include:

- **Engines being proposed by Republic are the General Electric T64 and the Rolls-Royce R. Da. 10. Latter is rated at 2,655 esph.**
- **Normal gross take off weight is listed as 77,500 lb. for the Rolls-Royce powerplants and 76,000 lb. with the General Electric engines.**
- **Span is 111 ft. 11 in., length 87 ft. and height 29 ft. 6 in.**
- **Cruising speed is set at over 390 mph. and range averages about 2,200 miles.**
- **Cruising altitude will be about 25,000 ft.**
- **Take-off roll at maximum gross weight is about 3,000 ft. and landing roll 4,000 ft. at sea level on a standard day.**
- **First class passenger capacity is 68 using three-and-two seating while tourist version will hold 80 passengers, some of them in three-and-three seating.**

Charles Butler Associates has been retained to do the interior decor and color scheme.

Bell helicopters have passed the most rugged test of all —

THE TEST OF TIME!

At work for more than 2,500,000 hours

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Because it's the actual "performance" — not "rehearsals" — that stands in the records, the Bell H-13 proudly points to its own .. more flight hours, lower maintenance costs, more dependability.. yesterday, today AND TOMORROW!

BELL H-13H FEATURES:

1. Longest approved overhaul period.
2. Interchangeable metal blades.
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DERATED ENGINE PROVIDES

1. Improved hot weather and altitude performance.
2. Maximum operating period between overhauls.
3. Reduced maintenance and greater reliability.
4. Reserve power for emergencies.
5. Maximum availability — Minimum cost.

BELL Helicopter CORPORATION
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Watch **"WHIRLYBIRDS"** *on TV .. consult your local paper for time and station*

Investors Ask Change in Aviation Policy

By Ford Eastman

Washington – Investment Bankers Assn. of America urged a complete review last week of government policies affecting the aviation industry.

In a report by the association's Aviation Securities Committee presented at the group's annual convention, it was recommended that government and industry begin working together immediately to try and find workable solutions to industry problems.

The committee said domestic trunk airlines and the aircraft manufacturers are fundamentally different components of the aviation industry and face two different sets of financial and governmental problems. The report said:

"Under the restrictions of Civil Aeronautics Board rate regulation, airlines lack the earning power and financial strength to serve the public adequately and to finance their new jet equipment expansion.

"Under the violent fluctuations of Defense Department procurement policy, aircraft manufacturers may find it increasingly difficult to obtain the capital funds and long-term credits necessary to finance their crucial role in America's air defense."

Stability Needed

To solve airline problems, the committee recommended that President Eisenhower appoint a qualified man to undertake a complete review of the Civil Aeronautics Act and CAB procedures under the act and present to the President and Congress a concrete program for constructive action.

The committee said the solution to aircraft manufacturers' problem lies in a congressional appropriation policy and a Defense Department procurement policy that will afford manufacturers adequate stability.

The group said that, as bankers who have to finance the growth of aviation and also as citizens, "We believe it in the public interest to present constructive suggestions concerning the airlines' and aircraft manufacturers' separate problems."

From the investment banker's viewpoint, domestic trunk airlines present a whole series of historical problems.

Airlines are subject, the committee said, to CAB utility-type regulation of fares and of operations plus the added hazard of enforced competition. A government ceiling is imposed upon earnings, while a free competitive economy determines cost and revenues.

The bankers charged that the CAB and its staff have not grown with the dynamics of the airline industry and the expansion of the national economy. Through rigid application of historical concepts and practices, the report said, the authority may unwittingly cripple the industry it is charged by law to encourage and develop.

Airlines must raise substantial sums of money to finance their re-equipment programs, the report pointed out, and are forced to compete with all alternative forms of investments, and with the profit records of all alternative industries bidding for the limited supply of investment funds. The investing public, it said, must be induced to allocate scarce funds to this segment of the nation's economy in the amounts needed.

"To achieve this necessary end," it added, "the airlines must be allowed, not only an adequate rate of return of total investment, but a sufficiently low operating ratio to provide earnings stability and growth and to give the investor a sense of confidence in the future profitability of the industry."

The investors said an adequate investment return and a safe operating margin will certainly require a general passenger fare increase. The alternatives, the committe added, are:

- **To admit that the U.S.**, with the world's wealthiest economy, can only afford a second rate air transport system.
- **To deny airlines** the financial strength needed to fulfill the public service function charged them by Congress.
- **To reverse the course** of progress, forcing the domestic trunklines from self-supporting independence to a socialized status in which non-user taxpayers must subsidize air transport users.
- **To drive the defense** budget higher as the government finances a military jet transport fleet when present plans are to rely upon the airlines' jet facilities, which would be available in emergency on 48 hours notice through the Civil Reserve Air Fleet.

Industry Problems

As for the aircraft industry, the committee said it too is regulated—by the level of defense expenditure. In recent years, it said that between 85% and 90% of total aircraft sales have been military. As a result, the report added, the bulk of the industry is subject to government limits on profits but not on expenses or losses.

The committee pointed out that aircraft contractors face the added hazard of renegotiation and forced refund of earnings up to four years after completion of contracts.

It also said the industry remains subject to violent expansion and contraction as a result of changes in world events, in defense strategy, in domestic politics, and in administrative decree.

As a result, the report added, the investment community has also judged aircraft manufacturers' stability inadequate for the risks involved.

Airlines, meanwhile, continued to present testimony of officials and financial experts designed to convince the CAB that a passenger fare increase is necessary to the airlines' financial health in the long, drawn-out General Passenger Fare Investigation.

Charles E. Beard, Braniff Airways president, took the stand last week and told the CAB that his airline needs a minimum fare increase of 12.5% to assure adequate future earnings.

$252 'Economy' Fare Approved by IATA

Paris—Agreements to introduce a new third-class "economy" fare on North Atlantic service and to increase present tourist and first-class fares on the same route were reached last week at the International Air Transport Assn.'s traffic conference here.

The fares will become effective April 1 provided each government involved approves the rate changes. An earlier attempt to increase North Atlantic fares was dropped because the Civil Aeronautics Board disapproved the proposals although all other governments concerned had granted approval of the rate increase.

Under the agreement, the present 15 day excursion fares will be discontinued. The economy fares will be about 20% less than tourist fares or $252 one-way and $463.50 roundtrip on the basic New York-London route.

First-class fares between New York and London will be increased from $400 to $435 on one-way tickets. Tourist rates will move from the present $290 one-way rate to $315.

Seating arrangement on aircraft designated for the economy service will be limited to a 34 inch pitch—the distance from the back of one seat to the seat in front of it. Such seats probably will be equipped to tilt only slightly. Tourist seats will have a 39 inch pitch, while first-class seats will have a 42 inch pitch. Sleeperette seats require a pitch of at least 47 inches.

Food service on the economy flights will be confined to sandwiches, tea, coffee, milk and mineral water. No alcoholic beverages will be served or sold on the economy flights.

Carriers will be free to operate aircraft in a tourist-first class configuration or a three-way configuration.

THE

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has completed an official British Ministry of Supply type test in accordance with the combined U.S./U.K. test schedule at a rating of

17,250 lb. THRUST

and is in production for the

HANDLEY PAGE VICTOR B. Mk. 2

The British Air Registration Board have already confirmed that a civil version of the same engine has successfully completed a 150 hour test run in accordance with the combined U.S./U.K. Civil Type Test Schedule at a dry take-off rating of 16,500 lb. thrust.

ROLLS-ROYCE AERO ENGINES LEAD THE WORLD

French, U.S. Negotiators Begin Review of Bilateral Agreement

Washington—French and U. S. State Department negotiators will meet here tomorrow to begin a complete review of the air transport agreement between the two countries that has been in effect since 1946. Airlines believe the discussions will be among the most important held in recent months.

Biggest issue expected to come up during negotiations is use of the Polar route between Paris and the West Coast of the United States. Both Trans World Airlines and Pan American World Airways are now flying the route, although the French claim they are not authorized to do so under the current bilateral.

Pan American's inaugural flight early in September touched off the controversy (AW Sept. 16, p. 43). As Pan American made plans for the first flight, French officials notified the State Department that the aircraft might not be permitted to land at Paris unless the U. S.-French bilateral was reopened to permit Air France access to the U. S. West Coast.

The flight took off under a cloud of confusion that still has not been resolved. However, it was permitted to land in Paris as were all following flights. TWA later inaugurated service without incident.

France claimed the current bilateral between the two countries does not authorize U. S. carriers to fly the Polar route to Paris and that no such route was in the making when it was signed.

U. S. authorities claim the current agreement allows American flag carriers to fly from any point in the U. S. to designated points in France and that the French carrier can fly from any point in France to designated points in the U. S.

Air France, with more unduplicated route miles than any other airline in the world, has long wanted a route to the West Coast, and renewed demands were made to review the agreement when TWA and Pan American began Polar service.

During the coming negotiations, France is expected to seek not only a West Coast route but also a Polar route to the Orient, with landing rights probably in Alaska. If the French do not obtain the rights from the U. S., they probably would seek them from Canada. Routes currently exchanged under the bilateral are as follows:

- **From the U.S.** via intermediate points over the North Atlantic to Paris and beyond to Switzerland, Italy, Greece, Egypt, the Near East, India, Burma and Siam to Hanoi and on to China and beyond. (This has been operated by TWA but not beyond India. After Jan. 1, however, TWA will operate beyond India to Manila to connect with Northwest Airlines.)
- **Over the North Atlantic** and Spain to Marseille or Nice and beyond via Rome, Budapest and points south of the parallel of Budapest to Turkey and beyond. (This has been operated by Pan American although all segments have not been served.)
- **Over the North Atlantic** and Spain to Algiers, Tunis, and beyond via intermediate points to Egypt and beyond—operated by TWA.
- **To Dakar, Pointe Noire, Brazzaville** and beyond via intermediate points to the Union of South Africa—operated by Pan American.
- **To Guadeloupe, Martinique** and beyond via intermediate points to French Guiana and beyond in South America—Pan American.
- **Via intermediate** points in the Pacific to New Caledonia and beyond on one or more routes to Australia—including Australia and New Zealand—Pan American.
- **Via intermediate** points in the Pacific and Manila to Saigon and beyond to Singapore and Batavia—Pan American.
- **Via intermediate** points in the Pacific, Manila, Hong Kong, Macao, and China to Hanoi and beyond via Siam, Burma to India and beyond—not in effect.
- **From France via** intermediate points over the North Atlantic to Boston, New York and Washington—operated by Air France with the exception of service to Washington.
- **Over the North Atlantic** and Montreal to Chicago—Air France.
- **Over the North Atlantic** to New York and Houston and beyond to Mexico—operated by Air France New York to Mexico without stops at Houston.
- **From Martinique via Guadeloupe** and via intermediate points to Puerto Rico and beyond via the Dominican Republic and Haiti to Miami (not operated).
- **From Martinique** via Guadeloupe to New York—not operated.

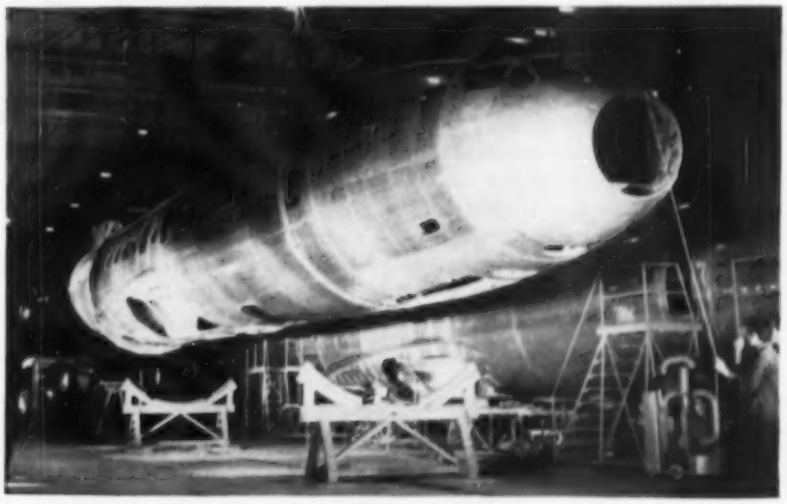
Counsel Would Reject Capital Fare Proposal

Washington—Civil Aeronautics Board bureau counsel said last week that Capital Airlines' proposed reduced group fare plan is discriminatory and should be rejected.

Capital proposed a reduced fare for groups of 25 or more traveling between specified points and originating or resuming on Saturdays or Tuesdays. The price of the proposed roundtrip fare would amount to 160% of the one-way first-class fare.

Counsel John M. Lothschuetz, in a brief to the CAB examiner, said the primary reason for Capital's proposed group fares is to promote new and additional traffic with a resulting increase in profits. He said that, while this may be a sound business consideration to support a reduced fare, it is not an adequate legal ground to justify a discriminatory fare.

The bureau counsel also said Capital failed to prove it can transport a group of 25 or more passengers at less cost than 25 individual passengers.



Caravelle Moves From Jigs

Fuselage of French Caravelle twin-jet transport (AW Oct. 28, p. 43), scheduled for delivery to Scandinavian Airlines System in 1959, starts out of jigs at Sud Aviation's St. Martin du Touch plant in Toulouse. SAS has ordered six Caravelles, has an option on 19 more.

Pneumatic controls

AiResearch is the largest designer and manufacturer of pneumatic controls for the aircraft and associated industries. During the past 10 years more than 300,000 units have been produced and are in service.

Temperatures of the fluids (including gas and liquids) range from −400°F to +2000°F at pressures to +6000 psig. The units operate at any ambient pressure at ambient temperatures from −300°F to over +1000°F. Line diameters range from ⅛ inch to 15 inches.

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SHORTLINES

► **Air France** has begun a new Caribbean service which links San Juan, Puerto Rico, with St. John's Antigua, Pointe-a-Pitre, Fort-de-France, Barbados, Port-of-Spain, Georgetown, Paramaribo and Cayenne. The service will run twice weekly. Air France also opened its new passenger terminal at New York International Airport's new Arrival Building on Dec. 5.

► **Braniff Airways** declared a dividend of 30 cents per share payable on Dec. 31 to shareholders of record as of Dec. 17. At the same time, Braniff announced October earnings of $265,478 as compared with $233,314 for October, 1956. Ten-month earnings were down from the same period last year; they dropped to $1,622,000 from $1,730,000.

► **British Overseas Airways Corp.** set a new company cargo record in the week beginning Nov. 18 by carrying 22½ tons of freight from New York to the United Kingdom on regular passenger-cargo flights. All the freight was carried on scheduled Boeing Stratocruiser or Douglas DC-7C flights.

► **Emery Air Freight Corp.** declared a cash dividend of 30 cents per share payable on Dec. 20 to stockholders of record as of Dec. 6. In making the announcement, the board of directors established a semi-annual dividend rate of 25 cents per share beginning with the next payment. In addition, a 2% stock dividend was declared, also payable on Dec. 20, to stockholders of record as of Dec. 6.

► **National Airlines** reports a net loss of $301,396 for the first quarter of Fiscal 1958. The airline had $11,157,039 in total operating revenues as compared with $11,161,541 for the same period of 1957; $11,395,267 in total operating expenses as compared with $10,555,253 for the same period of last year. Net loss was arrived at after provisions were made for $1,865,052 in depreciation and amortization charges and $40,500 for deferred federal income taxes.

► **Pacific Northern Airlines** has released 12-month figures on its Alaskan services which show that some of the towns served by the airline see more passengers moving in and out than there are residents in the towns. Anchorage, with 65,000 persons in the area, had 87,141 persons flying in or out on Pacific Northern planes, while Kodiak, a community of 2,500 persons, handled 15,182 passengers.

AIRLINE OBSERVER

► Major factor in United Air Lines decision to buy Boeing 707-720s instead of Convair 880s (AW Dec. 2, p. 42) was its desire to standardize jet maintenance on the Pratt & Whitney JT3, commercial version of the J57. United has been wary of establishing dual engine maintenance and, for this reason, had earlier turned down turboprop transports (AW Oct. 7, p. 38). The Convair 880 will be powered by General Electric CJ805 turbojets, the Boeing 720 by a new lightweight version of the JT3, which will power the Douglas DC-8 already on order by United for transcontinental service.

► **Hearings in the General Passenger Fare Investigation have had no apparent effect on airline common stock prices, indicating that investors have adopted a wait-and-see attitude in an unstable market. Since hearings may stretch into next summer, chances of airline stocks making any substantial recovery within the near future will be slight, particularly if year-end earnings dip as sharply as now anticipated (AW Nov. 11, p. 38).**

► Nonstop transcontinental passenger traffic is beginning to move upward after a disappointing November. Competition among American, TWA and United to capture a bigger share of the New York-West Coast market is commanding the chief attention of sales heads. TWA last month launched an all-out "saturation" sales drive in New York, using not only the local sales staff but traffic men from other cities, in a campaign to make deeper inroads into the market with its Lockheed 1649s.

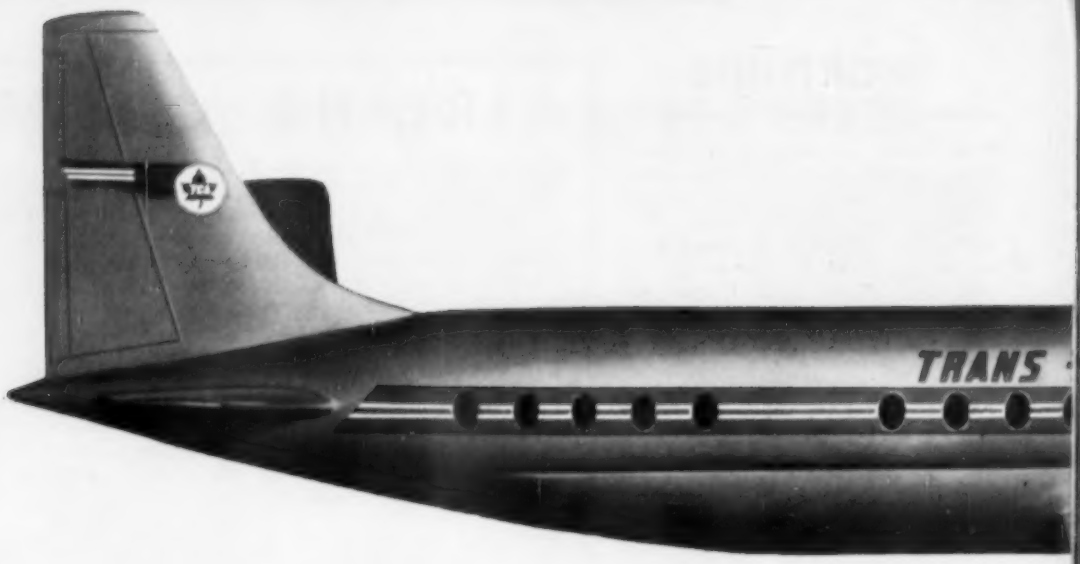
► **Pan American pilots have now officially announced to the airline that operation of the carrier's jet transports will not be discussed until the crew complement problem has been resolved (AW Dec. 2, p. 45). The pilots' stand is taken on grounds that the recent agreement between Flight Engineers' International Assn. and the carrier (AW Nov. 4, p. 25) "represents a direct conflict with ALPA policy as set by the (ALPA) Board of Directors . . ." ALPA wants to do away with the flight engineer on jet flights, add a third pilot.**

► Trans World Airlines has been officially reprimanded by the Civil Aeronautics Board for failing to obtain Board approval prior to suspending service at Chicago and Detroit on the carrier's international route. TWA has been authorized to suspend this service between November and May during the past three years but this year "inadvertently" failed to file a formal application for the suspension. In another reprimand, this one against Slick Airways for failing to wait for Board action on replacing direct service to Louisville and Pittsburgh with truck-air service via Indianapolis and Cleveland, the Board warned it was requesting Congress for authority to assess fines in such cases. The Civil Aeronautics Act does not provide for the imposition of civil penalties against carriers which change service without appropriate authority.

► **Civil Aeronautics Board has proposed amendments to Civil Air Regulations to prohibit scheduled international airlines and irregular carriers from taking off any aircraft when snow, frost or ice is clinging to the wings, control surfaces or propellers. A similar regulation has applied to domestic carriers for some years.**

► Faster aircraft and increased seating capacity are placing new demands on stewardesses by narrowing time available for serving meals aloft to a growing number of passengers. Turbine aircraft will intensify the problem, but reports by AVIATION WEEK editors traveling on scheduled airlines throughout the country indicate stewardesses can cope with the situation. Best time recorded thus far by AVIATION WEEK was on an Eastern Air Lines flight when two stewardesses served a total of 52 passengers in 17 minutes.

► **Civil Aeronautics Administration has called for project requests for the 1959 federal-aid airport program. Local government sponsors wishing to participate in the 1959 program must file new project requests before Feb. 1 The Fiscal 1959 program, for which $63 million has been authorized by Congress, will conclude the four-year federal aid approved by Congress in 1954.**



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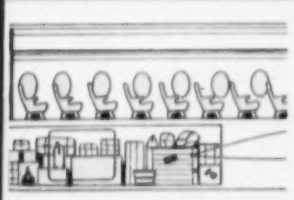
FLEXIBILITY

THE NEW DOUBLE-DECK JET-PROP **VANGUARD**

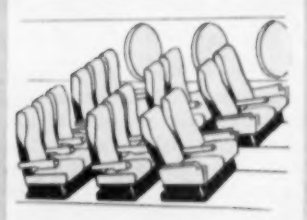
Without a doubt, the new Vickers Vanguard offers the greatest operational flexibility of any airliner ever designed. Though it is a de luxe passenger liner first and foremost, the Vanguard can, when required, operate profitably as an *all-cargo* plane! Result: the Vanguard is truly a *full-time* money-maker! Vanguards have already been ordered by British European Airways and Trans-Canada Air Lines. BEA ordered twenty. TCA also ordered twenty—with an option on four more—deliveries to start in early 1960. Into each Vanguard will be built over 2 million flying hours of Vickers jet-prop experience. And experience has no substitute!

2-IN-1 AIRCRAFT!



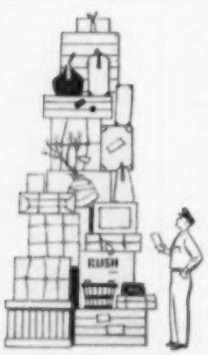
Because of its double-deck fuselage design, the new Vickers Vanguard is actually two aircraft in one! Though primarily a most economic passenger plane, it can also operate profitably as an all-cargo plane. Result: the Vanguard offers extraordinary operational flexibility—unmatched by any other airliner.

76, 86, 93, 120 PASSENGERS!



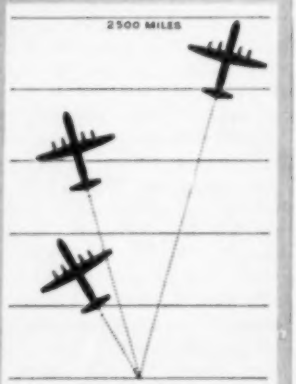
The Vanguard's luxurious upper deck passenger cabin features exceptional flexibility in layout . . . with capacities ranging from 76 for all first-class, up to 120 plus crew for all tourist — with mixed-class combinations in between.

10 TONS OF FREIGHT!

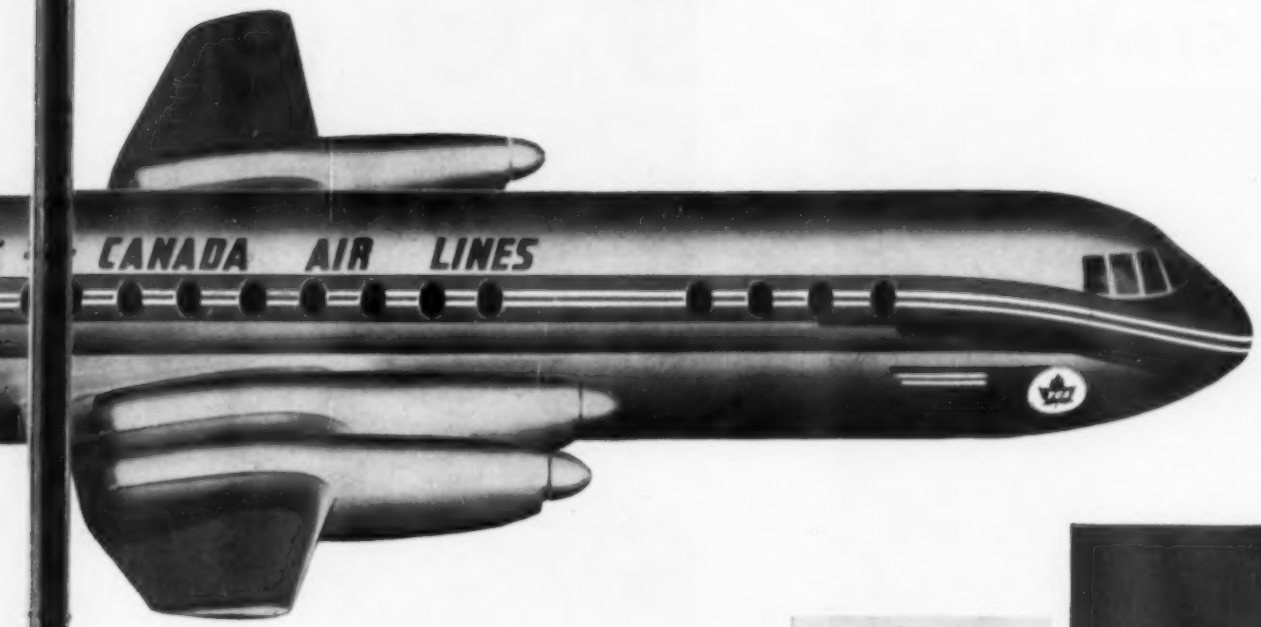


The Vanguard's two huge lower deck cargo holds have a capacity of nearly 1400 cu. ft.—enough to carry 10 tons of freight with no modification in the upper deck!

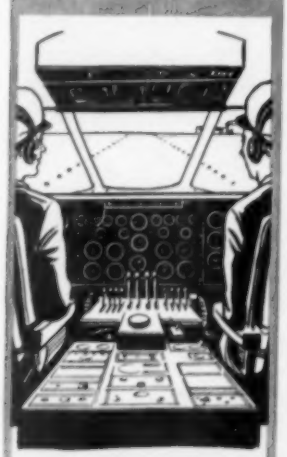
WIDE RANGE OF STAGE LENGTHS!



The Vanguard can be operated economically on short, high-density routes . . . first-class medium hauls . . . or all-cargo services over a wide range of stages. With full payload, the Vanguard has a 2500-mile range.



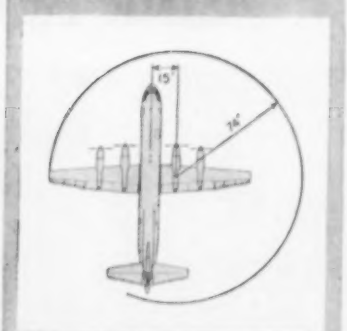
NO EXTRA-LONG RUNWAYS NEEDED!



The Vanguard offers great flexibility in routing . . . it can safely use the existing runways of most airports.

The Vanguard's spacious cockpit features simplicity and unsurpassed visibility.

FASTER TURN-AROUND!



Special design features of the Vanguard cut time on the ground—lower operating costs to a minimum. A minimal turning circle of 74 feet, and excellent visibility that enables the pilot to see both outer engines and wing tips, mean the Vanguard can be taken in and out of the most crowded ramps safely and quickly.

Cabin doors fore and aft with built-in folding stairs assure rapid passenger handling. Extra-wide cargo-hold doors at truck level, permit simultaneous loading and unloading. With its low tire pressures, the Vanguard does not have to wait to use a particular part of the apron. All this gives the Vanguard more time where it should be— in the air!

GREATER SPEED, GREATER ECONOMY!

With four powerful Rolls-Royce Tyne jet-prop engines, the new Vanguard will be capable of speeds up to 425 mph. It will have a development potential for even higher speeds.

Years of experience and careful study have proved that for greatest economy over a wide range of stage lengths, the jet-prop is supreme.

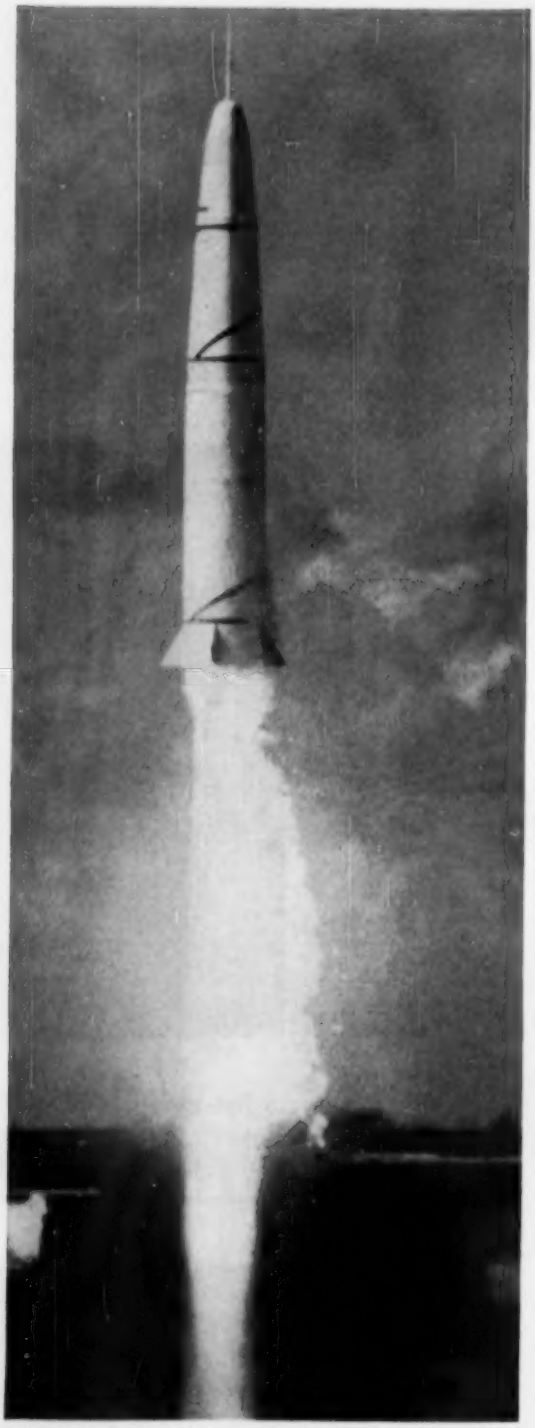
U. S. REPRESENTATIVE:
CHRISTOPHER CLARKSON
10 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

jet-prop VICKERS VANGUARD

POWERED BY FOUR ROLLS-ROYCE TYNE ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LTD.,
WEYBRIDGE, ENGLAND • MEMBER COMPANY
OF THE VICKERS GROUP

MISSILE ENGINEERING

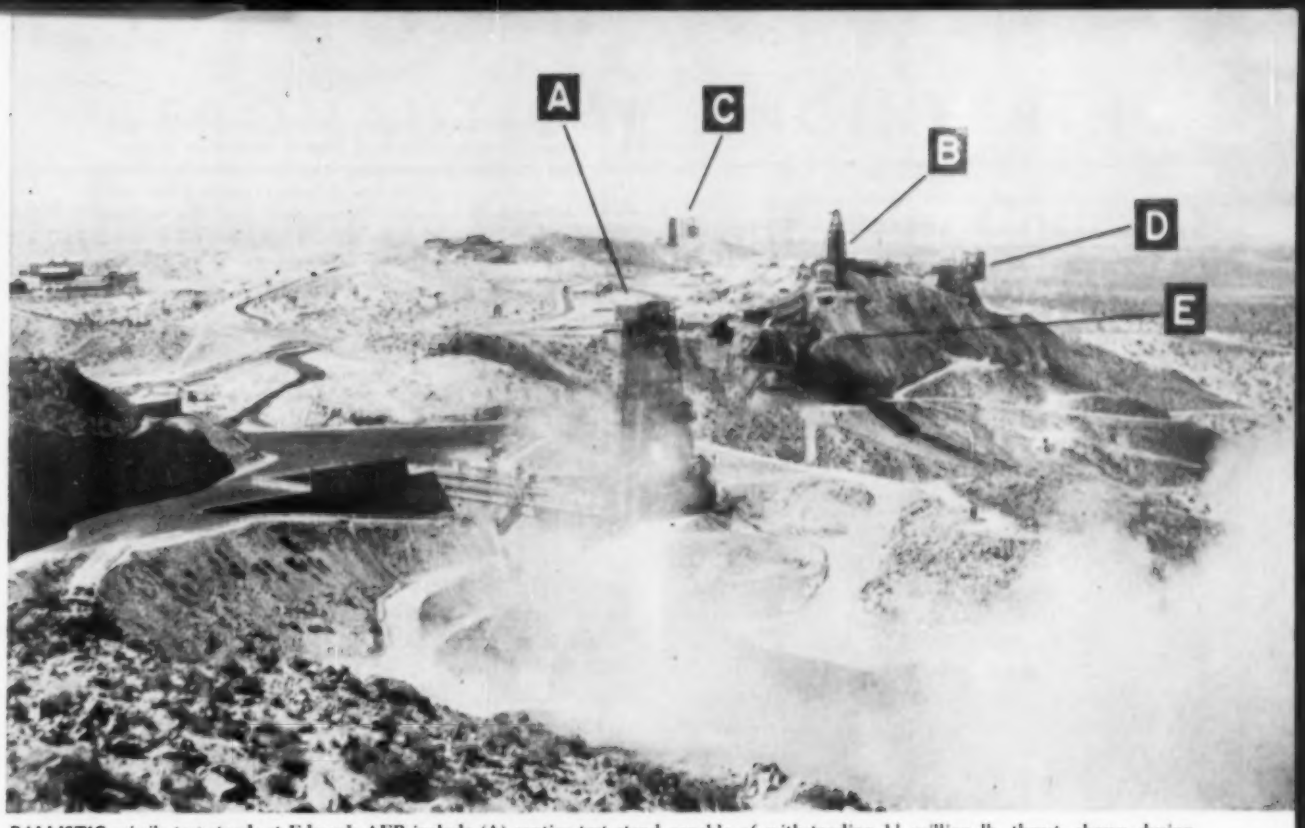


DOUGLAS Thor rises from launching pad at Cape Canaveral, Fla., in the payoff phase of the test cycle. Faint lines discernible in exhaust outline 165,000 lb. thrust Rocketdyne motor combustion chamber and shock waves.

CAPTIVE tests of Atlas systems are conducted at Sycamore Canyon, northeast of San Diego. Test stand in foreground was completed this year; that in background in 1956.

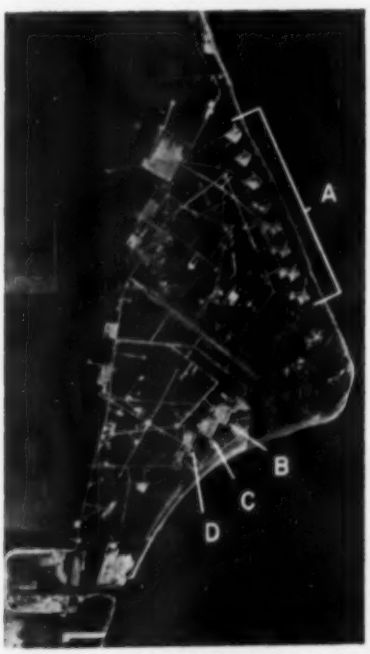
Static Facility Complex

THOR launching pad and gantry crane are shown in the center of this photograph, taken at Patrick AFB, Florida. The storage facility in the foreground contains a supply of liquid oxygen.



BALLISTIC missile test stands at Edwards AFB include (A) captive test stand capable of withstanding 1¼ million lb. thrust, shown during Atlas ICBM firing; (B) Atlas stand called "battleship" because missile configuration used is not true Atlas but heavy "boiler plate" mo del used to check out components; (C) captive test stand for Thor IRBM; (D & E) engine test stands for Atlas and Thor powerplants.

Prepares Ballistic Missiles for Launching



STRING of eight ICBM pads (A) at Cape Canaveral is 15,000 ft. long. (B & C) are Thor pads. (D) is Jupiter launch site.

TITAN ICBM captive test stand at Martin Co.'s Denver facility is designed to accommodate "battleship" type missile of heavy steel plate used to check out plumbing and other components. Aerojet powerplant for Titan will be fired in this stand in the near future.

IV

This is the fourth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

How Heat-Treatment Affects Alloy Steels

There are in general five different forms of heat-treatment used with hot-rolled alloy steel. These treatments modify the mechanical properties of the steel to suit the end use. Basically, heat-treating may be defined as an operation or series of operations involving the heating and cooling of steel in the solid state to develop the required properties.

The five forms of treatment mentioned above, as applied to constructional alloy steels, are discussed in the following paragraphs:

(1) QUENCHING AND TEMPERING usually consists of three successive operations: (a) heating the steel above the critical range, so that it approaches a uniform solid solution; (b) hardening the steel by quenching it in oil or water; and (c) tempering the steel by reheating it to a point below the critical range in order to effect the proper combination of strength and ductility.

(2) NORMALIZING is a form of treatment in which the steel is heated to a predetermined temperature above the critical range, after which it is cooled slowly to below that range in still air. The purpose of normalizing is to promote uniformity of structure and to alter mechanical properties.

(3) ANNEALING consists of heating the steel to a point at or near the critical range, then cooling at a predetermined rate. Annealing is used to develop softness in steel, to improve machinability, to reduce stresses, to improve or restore ductility, and to modify other properties.

(4) SPHEROIDIZE-ANNEALING is the prolonged heating of steel at an appropriate temperature, followed by slow cooling to produce a globular condition of the carbide. This treatment produces a structure which may be desirable for machining, cold-forming or cold-drawing, or for the effect it will have on subsequent heat-treatment.

(5) STRESS-RELIEVING is the process of reducing internal stresses by heating the steel to a temperature below the critical range and holding for a time interval sufficient to equalize the temperature throughout the piece. The object of this treatment is to restore the elastic properties of the steel, or to reduce stresses that may have been induced by machining, cold-working, or welding.

Bethlehem metallurgists have had long experience in all methods of heat-treating. They understand the possibilities and limitations of each method with respect to various alloy steels. These men will be glad to help you with any problems concerning heat-treatment. Feel free to ask for their services.

And call on Bethlehem, too, for the full range of AISI standard alloy steels, as well as special-analysis steels and all carbon grades. We can meet your needs promptly.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

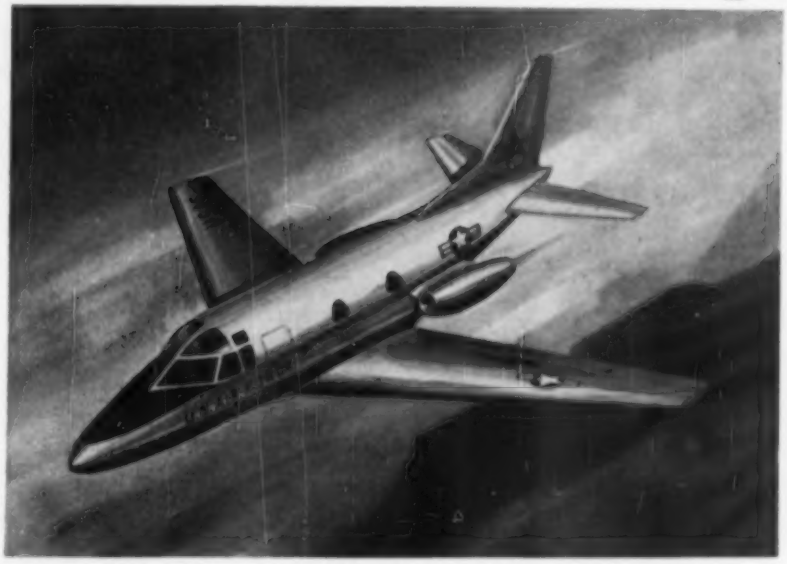
Sabreliner Fits USAF Shelf Item Concept

By Irving Stone

Inglewood, Calif.—Prototype Sabreliner, North American Aviation's twin-jet utility trainer, projected to meet Air Force requirements, is being pushed to meet a scheduled May 15, 1958, rollout date. First flight is targeted for the following month.

Design drawings are pratically all released to manufacturing. Tooling is about 95% complete. Skins, frames, ribs and some detail parts already have been fabricated, and assembly work is getting under way.

Design and supporting groups, numbering about 100 people, are headed by project engineer Fred Prill.



DRAWING shows configuration of North American Sabreliner off-the-shelf utility trainer.

Plane's Capabilities

Small—43 ft. long; light—15,330 lb. gross; fast—500 kt. top speed; long-range—1,200 nautical miles; the Sabreliner has a basic capability of hauling four passengers and crew of two. Plane's training and general capabilities are projected to include:

- **Jet procedures** and techniques.
- **Single engine** procedures.
- **Jet transition** training.
- **Night and instrument** flying.
- **Navigational** training.
- **Radar observer** and electronic countermeasure training.
- **Target-towing** and chase.
- **Ground control intercept** training, with plane being used as a ground control intercept target to obviate need for more operationally expensive intercept aircraft.
- **Logistics support** of combat aircraft. High speed of Sabreliner allows fast delivery of high priority spare parts and key maintenance personnel. No point in U.S. would be farther than 6 hr. flying time.
- **Air-sea rescue work**—dropping flotation gear and other items until pickup vehicle takes over.

Desirable Type

Air Force specifications for the plane type (official designation, UTX utility trainer) which the Sabreliner represents were promulgated in August, 1956. At that time requirements were seen for 1,000 to 1,500 of these lightweight twin-engine jets.

North American will not comment but AVIATION WEEK has learned from a reliable source that in addition to the Air Force, it is likely that the Navy, Marine Corps and Army also will have a requirement for a plane of this type.

At the present time, North American has no plans for commercial application of the Sabreliner. It is being projected only for the military market.

At the time Air Force specifications were promulgated, flyaway price suggested for the UTX plane in the specifications was $200,000.

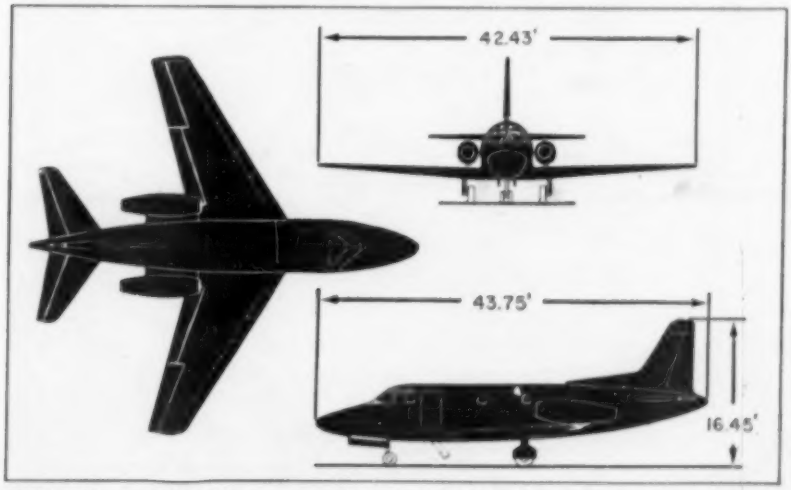
North American is financing the Sabreliner prototype with its own funds, and cost of development of this initial article may run as high as $8 million. Pending receipt of orders, North American plans to build but a single prototype, which will serve as a flight test article and demonstrator.

CAA Certification

In its specifications, the Air Force stipulated "that plane should be suitable for CAA certification." North American has applied for a CAA type certificate and already has had several type board meetings with CAA.

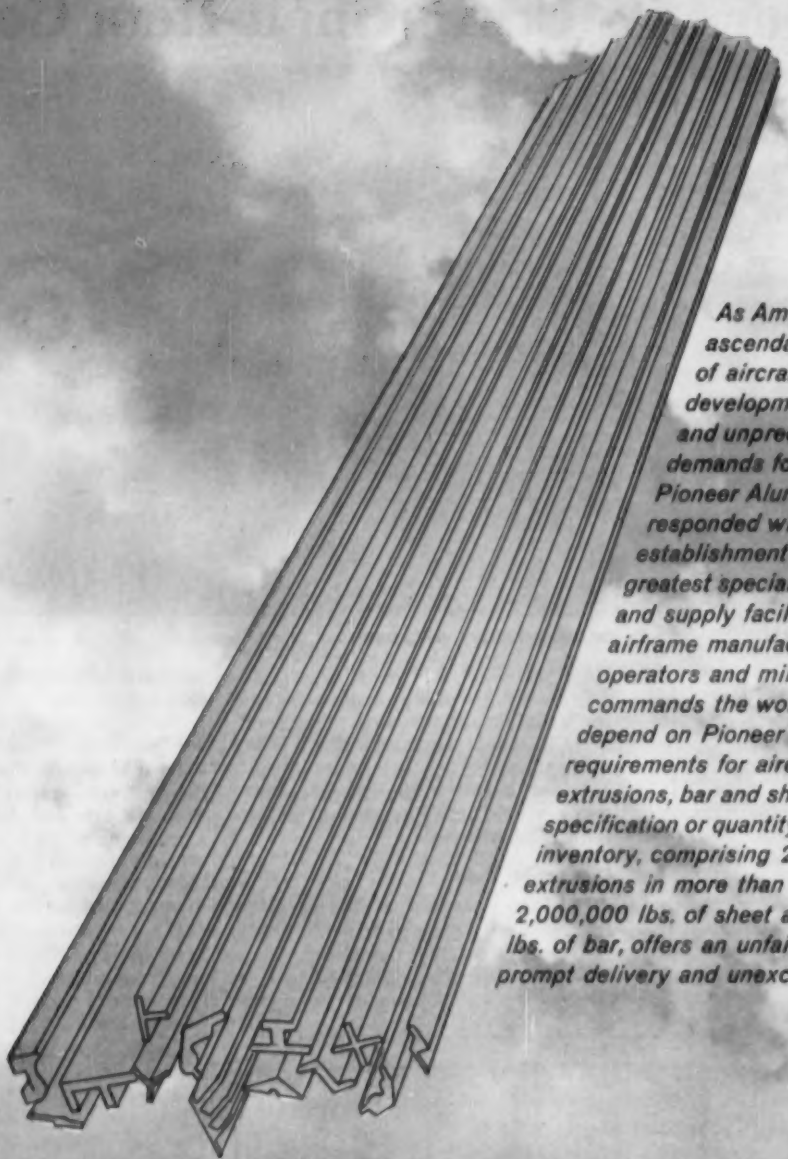
It is expected that the turbojet engines, General Electric J85s, will be type-certificated for 50 hr. between overhaul when the prototype Sabreliner is ready to receive them.

At the time UTX specifications were



FUSELAGE-mounted engines were moved from original location in wing roots.

KEEPING UP WITH THE PROGRESS OF FLIGHT



As America's ascendancy in the world of aircraft and missile development created new and unprecedented demands for materials, Pioneer Aluminum Inc. responded with the establishment of the world's greatest specialized warehousing and supply facility. As a result, airframe manufacturers, airline operators and military aircraft commands the world over today depend on Pioneer to meet their requirements for aircraft aluminum extrusions, bar and sheet, regardless of specification or quantity. A huge floating inventory, comprising 2,000,000 lbs. of extrusions in more than 4,500 shapes; 2,000,000 lbs. of sheet and 1,000,000 lbs. of bar, offers an unfailing supply, prompt delivery and unexcelled service.

100,000 SQ. FT. DEVOTED EXCLUSIVELY TO THE WAREHOUSING OF AIRCRAFT ALUMINUM EXTRUSIONS, BAR AND SHEET

PIONEER ALUMINUM INC.

SUBSIDIARY OF MORRIS P. KIRK & SON, INC., PACIFIC COAST UNIT OF NATIONAL LEAD CO.

5251 WEST IMPERIAL HIGHWAY • LOS ANGELES 45, CALIFORNIA • PHONE OREGON 8-7621

issued, the Air Force also issued requirements for a UCX utility transport—a medium-weight multi-engine configuration. Requirement was seen for 200-300 aircraft of this type. Lockhead Aircraft's CL-329 Jetstar (AW Sept. 30, p. 108), a 10-passenger configuration which has already flown, is aimed at meeting this Air Force specification. First prototype is powered with two Wright TJ37s. Second prototype, to fly next summer, is scheduled to be powered with four J85s, although Fairchild's J83 also is a powerplant possibility. Lockheed's UCX and North American's UTX are not directly competitive.

Fuselage nose cone is plastic to accommodate glide slope and weather radar antennas. In the pressurized section just aft of the nose cone and just ahead of the cockpit, Collins Radio navigation equipment is installed. This includes glide path and localizer, VHF communication, dual-VOR navigation, marker beacon, flight director system, interphone and ADF.

Supported on a Robinson Aviation

Sabreliner Basic Data

Length	43.75 ft.
Height	16.45 ft.
Wing span	42.43 ft.
Wing area	334 sq. ft.
Sweep, 25% chord	28.5 deg.
Tail span	17.55 ft.
Passengers	4
Crew	2
Empty weight	8,153 lb.
Fuel (850 gal. JP-4)	5,523 lb.
Crew and passengers	1,280 lb.
Chutes and baggage	374 lb.
Gross takeoff weight	15,330 lb.
Takeoff distance (15,330 lb.) over 50-ft. obstacle	3,950 ft.
Takeoff single engine	5,100 ft.
Top speed	500 kt.
Cruise at 41,000 ft. average altitude	436 kt.
Range with 6 occupants and baggage (includes fuel reserve for 30 min. loiter at 20,000 ft. and 5% fuel reserve on landing)	1,200 naut. mi.
Range, with two 120-gal. slipper-type tanks fitting over leading edge	1,500 naut. mi.
Landing (touchdown at 86 kt.) ground roll	1,200 ft.
Landing over 50-ft. obstacle	2,100 ft.

SINGLE-PIECE wing panel for Sabreliner has integral stiffeners milled in. The skin panel reaches from the wing root to the tip.

PNEUMATIC SYSTEMS ENGINEERS

Wallace O. Leonard, Inc., designs and manufactures hydraulic and pneumatic devices that regulate, control and measure pressure or flow. From our wide range of proprietary items, the pneumatic pressure regulator pictured is typical.

LEONARD CANOPY SEAL PRESSURE REGULATOR

Inlet pressure range: 15 to 3000 PSIG
Flow range: 0 to 150 cu. in./min.
Outlet pressure range: 5 to 60 PSIG
Weight: .16 pounds

your inquiry is invited

For further information on this pressure regulator or consultation on your needs for similar products please write, wire or telephone the nearest Leonard representative listed below. Their experienced sales engineers will be pleased to assist you.

IN SEATTLE—Associated Industries, 1752 Rainier Avenue, Seattle 44, Wash. Telephone Minor 4400 or TWX SE-202.

IN WICHITA—Associated Industries, Inc., 455 South Washington, Wichita 7, Kan. Telephone HObart 4-0391 or TWX WI-266.

IN GREATER NEW YORK—Brierley, Davis Company, 332 Springfield Avenue, Summit, N.J. Telephone CRestview 3-7300 or TWX Summit NJ 355.

IN SOUTHERN CALIFORNIA—Control Components Company, 35 North Arroyo Parkway, Pasadena, Calif. Telephone RYan 1-5172 or TWX Pasa Cal 7175.

LEONARD PASADENA

Wallace O. Leonard, Inc.

373 South Fair Oaks Avenue, Pasadena, Calif.

shock-mounted shelf with integral cooling air passages, all this avionic equipment is of modular construction for ease of maintenance. It is accessible from ground level through lift-up hood type doors on either side.

Space beneath the radio compartment accommodates the dual-wheel steerable nose gear.

Compact Cockpit

Cockpit enclosure accents visibility. This is immediately evident when sitting in the mockup's cockpit. Two front panes (NESA-heated glass) form a V-section. This is followed by two stretched-acrylic side panels defogged with hot air. Two top stretched-acrylic panels give upward visibility and are coupled with two smaller top panels for additional upward sighting in a bank.

Cockpit area is small but exceedingly compact. Pilot has everything within reach, so that plane can be operated completely from left hand seat. Instruments and controls in the cockpit have been made final by drawing on experience of North American test pilots and a wide group of military pilots who would be flying this type of aircraft if it were adopted by the services.

Control column is a complete assembly supplied by a vendor. It incorporates longitudinal and lateral actuating mechanism, as well as rudder pedals, brake controls, gust lock and parking brake.

Single entrance and exit door is a plug-type unit. After a turn on the handle, the door is pulled in slightly; then it rotates outward and down to form a stairway. Door meets requirements of emergency escape and allows exit in event of a belly landing.

Escape hatch, 20 x 30 in., is centrally located in the floor between cockpit and cabin. It is sealed with a jettisonable pressure-barrier door in the fuselage bottom. To use this hatch, plug-type floor panel first is raised. This extends the speed brake, which acts as a wind deflector, and also operates the dump valve to decompress the cabin. Pulling on the handle of the pressure-barrier door in fuselage bottom jettisons the door and leaves the opening clear (behind speed brake) for in-flight bailout.

For equipment drop, pressure-barrier door would be removed before the flight mission.

A ground-escape emergency exit is located on the right hand side of the cabin area.

Opposite entry door is a baggage rack. Alongside and aft of entry door is coat rack space. Prototype will not provide for buffet installation although room is available for it alongside baggage rack.

Seating Arrangement

In this basic prototype version are four 16G passenger seats, two on either side of the aisle space, facing each other, with room for a table between to simulate conference grouping. Each seat is opposite a window.

Aft of cabin proper is a toilet area, which also could accommodate a wash basin if desired. Pressurized area ends aft of toilet area.

Cabin is pressurized to 8,000 ft. at aircraft altitude of 45,000 ft. Provisions have been made for emergency oxygen to be supplied automatically to each passenger. Oxygen will be stored at 1,800 psi. and dropped to 400 psi. when brought into regulator in pressurized area.

Regulator will meter it through a diluter-demand system. If cabin goes above 9,000 ft., aneroid control will turn on oxygen and automatically open access door to oxygen-mask compartment above each two seats. As passenger removes mask from compartment, oxygen will be turned on to the individual mask, a symmetrical type coated on the inside with adhesive to seal it to the face.

Fuselage section aft of pressure bulkhead houses heating and ventilating equipment, batteries, and hydraulic sys-

-on the shelf

Beware!

Do not accept

a heavy-low efficient blower that does not meet all specifications. It can prove to be very expensive.

At Dean and Benson no fans or blowers are carried in stock. Each unit is specifically designed to meet the characteristics of the particular system and the duty cycle to which it will be subjected.

Dean and Benson can provide a blower to meet complete customer requirements—with procurement time measured in days.

We welcome inquiries —

D&B RESEARCH

DEAN & BENSON RESEARCH, INC.

16 RICHMOND STREET CLIFTON, NEW JERSEY

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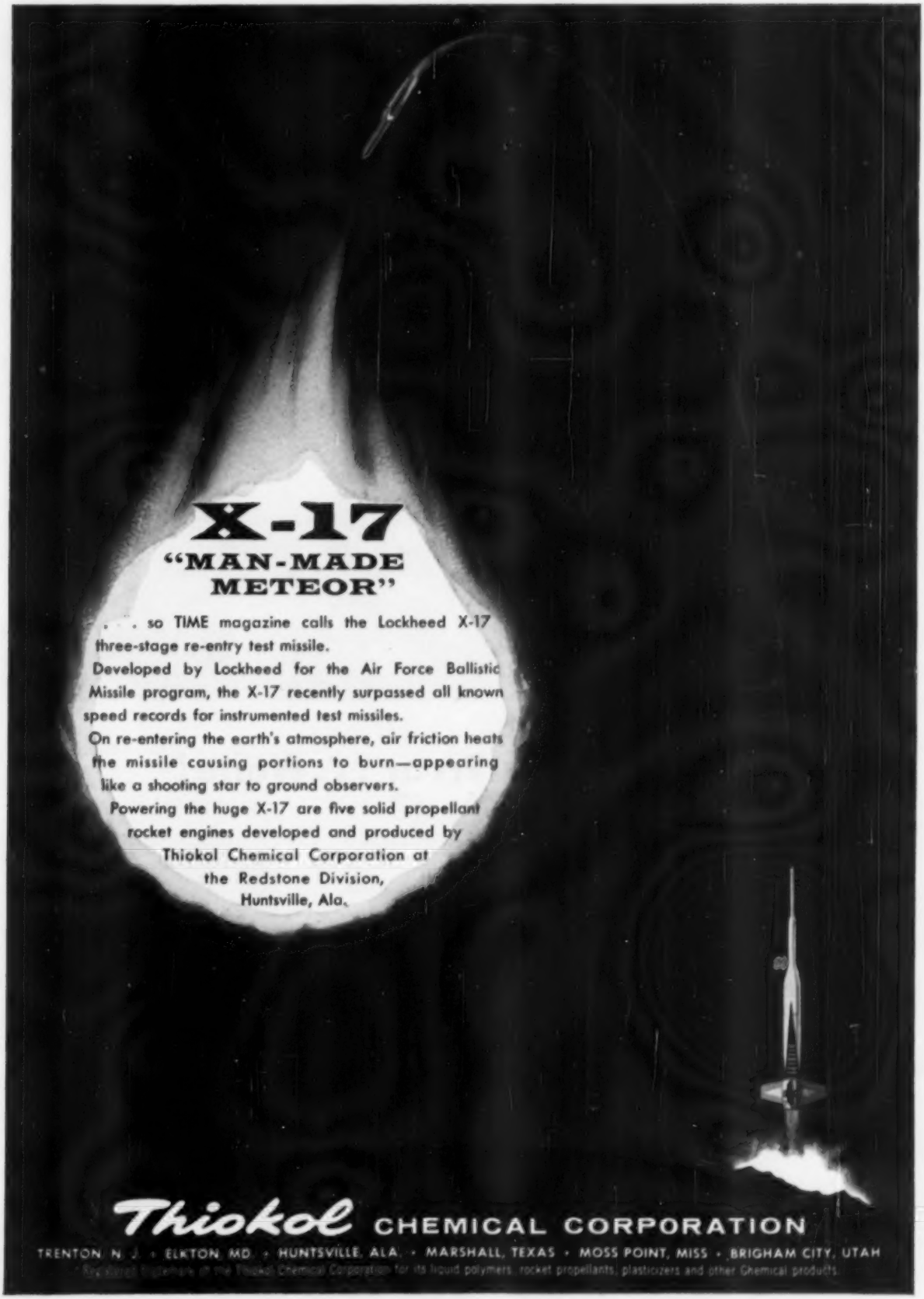
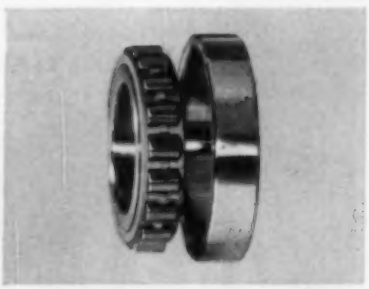

X-17
"MAN-MADE METEOR"
. . . so TIME magazine calls the Lockheed X-17 three-stage re-entry test missile.
Developed by Lockheed for the Air Force Ballistic Missile program, the X-17 recently surpassed all known speed records for instrumented test missiles.
On re-entering the earth's atmosphere, air friction heats the missile causing portions to burn—appearing like a shooting star to ground observers.
Powering the huge X-17 are five solid propellant rocket engines developed and produced by Thiokol Chemical Corporation at the Redstone Division, Huntsville, Ala.
Thiokol CHEMICAL CORPORATION
TRENTON, N. J. • ELKTON, MD. • HUNTSVILLE, ALA. • MARSHALL, TEXAS • MOSS POINT, MISS • BRIGHAM CITY, UTAH
Registered trademark of the Thiokol Chemical Corporation for its liquid polymers, rocket propellants, plasticizers and other Chemical products

Margin for Error . . . *None!*

You swing into your final approach. At precisely the right instant the Landing Signal Officer flags you to cut your power—and you're aboard! ☆ Such skill and precision is indicative of that which is required today in *every* phase of the aircraft industry. The bearings in modern jet turbines, for instance, must be held to accurate tolerances measured in millionths of an inch. That's why the leading jet turbine manufacturers specify Bower aircraft bearings first. Their exceptional high quality and unerring precision allow Bower bearings to stand unbelievable turbine speeds and temperatures—that match the supersonic speeds of today's jet aircraft—*with a minimum of lubrication.* ☆ Whatever *you* produce, if it uses bearings, specify Bower! Choose from a complete line of tapered, straight and journal roller bearings for every field of transportation and industry.

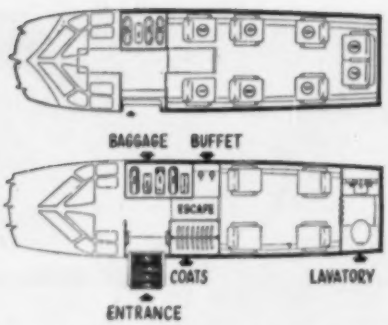
BOWER ROLLER BEARING DIVISION
FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 14, MICHIGAN



IDEALLY SUITED TO HIGH-SPEED OPERATION

Built to hold their precision indefinitely, these aircraft bearings are recommended wherever superior quality and high-speed operation are required. For some applications, a special alloy steel—developed jointly by Bower and several aircraft companies—is used.

BOWER ROLLER BEARINGS



ALTERNATE seating version for eight (top) is contrasted with the basic Sabreliner layout (bottom). This has four passenger seats, buffet, baggage compartment.

tem for landing gear, speed brake and wheel brakes. In leading edge of dorsal, where it meets fuselage top, is an air inlet to heat exchanger for heating and ventilating system.

Plastic tail cone houses secondary UHF antenna, with primary antenna housed in plastic tip on top of the vertical stabilizer.

Interior Arrangements

Alternate schemes for fuselage interior are for cargo or higher density seating arrangements. By removing movable partitions, seats, and baggage and clothing racks, cabin interior may be converted into a cargo area accommodating up to 2,500 lb. in units up to 25 cu. ft. (imposed by door limitations). Seat tiedown fittings also serve as cargo tiedowns.

Through elimination or modification of baggage space, coat area or comfort facilities, a higher density seating arrangement may be realized to allow up to eight passengers.

Original Sabreliner design accommodated engines in the wing roots. This has been changed to provide for pod-mounted units supported horizontally from aft fuselage section. Change has improved plane's aerodynamic characteristics, also facilities adoption of different powerplant units. Horizontal pylons for jet engines are tied to heavy frames aft of the fuselage pressurized area.

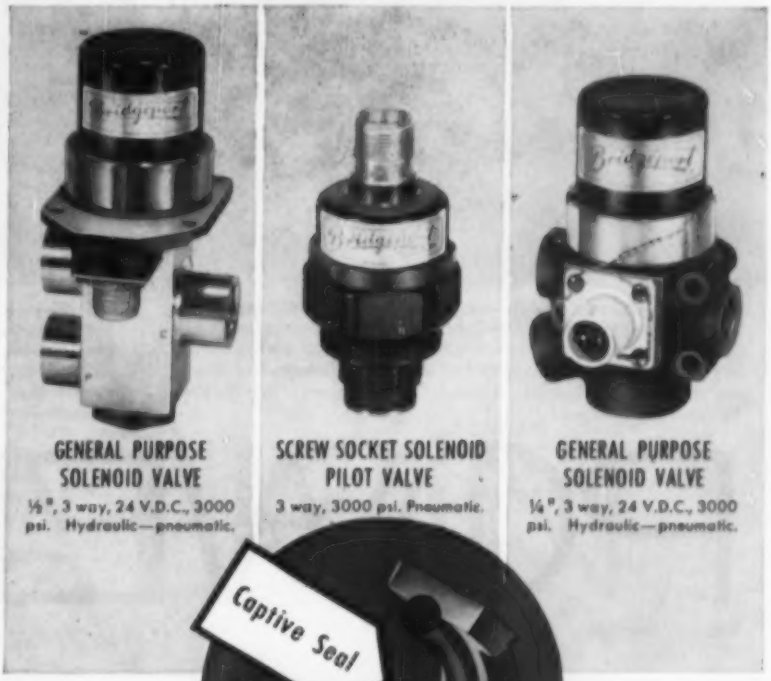
Safety Measure

While nacelle intake overlaps the pressurized area, the turbine section is aft of the pressure cabin to eliminate any possibility of pucture as a result of turbine blade failure.

Nacelle minimum spacing from fuselage is about 6¼ in. Nacelle intake extends over wing trailing edge by about 10% of wing chord. Nacelle exhaust is directed below empennage at an angle of approximately 5 deg.

Engine scheduled for the Sabreliner is General Electric J85, but the pylon

Captive Seal® is big feature of these **NEW** Aircraft Valves



GENERAL PURPOSE SOLENOID VALVE
½", 3 way, 24 V.D.C., 3000 psi. Hydraulic—pneumatic.

SCREW SOCKET SOLENOID PILOT VALVE
3 way, 3000 psi. Pneumatic.

GENERAL PURPOSE SOLENOID VALVE
¼", 3 way, 24 V.D.C., 3000 psi. Hydraulic—pneumatic.

Even low contact pressure insures bubble-tight seal

Clean contact break at either of 2 points

Unlike this typical face seal, the CAPTIVE SEAL is blow-out-proof!

A *new* line of compact, light-weight aircraft valves featuring the blow-out-proof BERGEN CAPTIVE SEAL is now manufactured and distributed by Bridgeport, nationally prominent supplier of aircraft bellows and bellows assemblies.

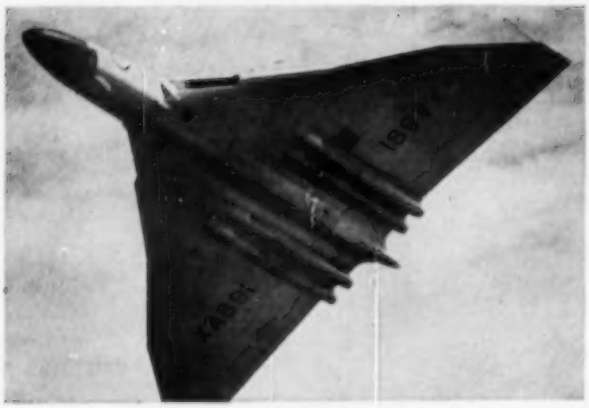
These valves are designed to withstand high temperature and pressure stresses. Steel retainer or hoop provides *two* breaking points that *instantly* release pressure imbalance when seal is broken.

The CAPTIVE SEAL is *wear-proof*—even abrasive particles in the fluid stream cannot damage it! Quickly replaced by anyone.

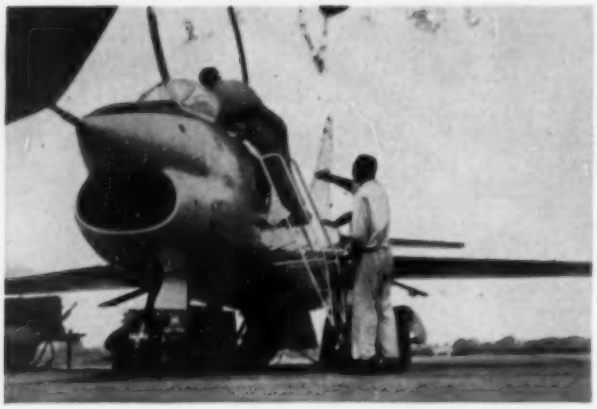
Write for new catalog with complete technical data!

Robertshaw-Fulton CONTROLS COMPANY

BRIDGEPORT THERMOSTAT DIVISION • MILFORD, CONN.



Bristol Olympus—world's most powerful type-tested turbojet. The Olympus, through its Bristol-pioneered "twin-spool" system, has twice captured the world's altitude record for turbojets. It has been type tested at 16,000-lb. thrust—more powerful than any other type-tested jet. Olympus engines power the RAF's Vulcan atom-bombers.



Lightweight leader—the Bristol Orpheus is an outstanding lightweight power plant, in world-wide demand for fighters, strike aircraft, executive transports, and trainers. Already the Orpheus has been chosen to power 12 different aircraft being built in 8 countries. Shown here is the Orpheus-powered Fiat G91 lightweight strike aircraft—for NATO.

POWER IN

The Proteus free-turbine turboprop is in world-wide operation in the Bristol Britannia. Flexible, quiet, reliable—the 4,120-horsepower Proteus is the most powerful and economical turboprop engine in airline service. And in less than eight months its overhaul life has been extended from 500 to 1,050 hours!

Bristol Thor-type ramjets power Bristol Bloodhound guided missiles, recently adopted as the mainstay of Britain's air defense. The Thor is a fully developed power plant, producing great power at high Mach numbers in the upper air, and is also suitable for mixed-power aircraft and test vehicles.

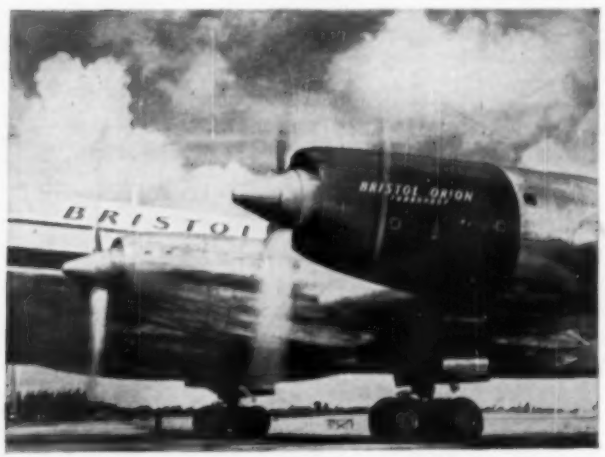
The Bristol Perseus of 1932 started the famous line of Bristol sleeve-valve radial engines. Over 70,000 Hercules and Centaurus engines—latest of this classic breed—have been built, both types being notable for their lengthy overhaul lives and operational reliability.

AVIATION

Versatile Bristol engines speed world-wide aviation progress

The brilliant Bristol Britannia is only a part of the Bristol story. Another part is to be found in the design offices, laboratories and production shops of Bristol Aero-Engines Limited. Here, for nearly forty years, Bristol designers have been producing power for the wings of the world. Power for defense. Power for civil air transport.

From piston engines to the most advanced ramjet guided missile power unit, Bristol engines have consistently pioneered new design principles—demonstrated their unparalleled reliability.



World's first supercharged turboprop—the new Bristol Orion has an outstanding power-to-weight ratio in cruising flight combined with a specific consumption better than the leanest existing engines.

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will also accommodate Fairchild's J83. (Both engines deliver about 2,450 lb. thrust.)

The J85 can be removed easily with use of a simple Mk. VIII type bomb hoist, by lowering the powerplant through the access door in the bottom of nacelle. Engine installation is easily accessible at just about shoulder level for easy reach in ground maintenance.

There is a self-sufficient engine starting system incorporated. This is a combination starter-generator on each engine, which draws power from nickel-cadmium batteries. Engines also can be started with ground cart.

Wing Features

Low wing is swept at 28.5 deg. at 25% chord line. Wing section has an average 10% thickness. Aerodynamically actuated leading edge slats are employed, as in North American's F-86 and F-100 series.

From tip to tip between front and rear spars, including center wing section box, entire wing is fuel tank area. Wing skins, fabricated with integral stiffeners, extend in single panels from root to tip. Doors in top skin give access to fuel system equipment in the various fuel tank bays. Fuel system uses single point pressure refueling, located on underside of leading edge of right hand wing.

Main landing gear attaches to wing rear spar, folds inward with wheels housed under fuselage. Leading edge of wing and empennage are thermally anti-iced, using engine bleed air.

All control surfaces—ailerons, rudder and elevators—are aerodynamically balanced and are actuated by a simple mechanical control system. North American's philosophy here was to improve maintainability in an area normally requiring considerable attention. For trim, entire stabilizer is electrically actuated. On rudder and aileron there are electrically operated trim tabs. Landing flaps also are electrically actuated.

Structural Details

Fuselage incorporates four major extruded longerons continuous from just aft of plastic nose back to plastic tail cone.

Two of these longerons run right above height of wing center section box. Upper longerons are at upper portion of elliptical fuselage.

With exception of primary bulkheads, frames are constant-depth formed sheet about 2½ in. wide and spaced, generally, on about 9 in. centers.

Major bulkheads located at forward end of pilot's compartment, forward and aft of main entrance door, and at wing front and rear spar positions, are built up of sheet metal, extrusions and machined fittings. Aft pressure bulkhead is bonded all-metal aluminum alloy honeycomb sandwich. In addition to serving as a pressure barrier, this bulkhead also serves as main support member for engine pylons.

Heavy, canted bulkhead at fuselage rear supports vertical stabilizer rear beam and carries vertical stabilizer bending into fuselage. This bulkhead also has fittings to support horizontal stabilizer rear beam, on which stabilizer is pivoted.

Floor in passenger compartment also is bonded all-metal aluminum honeycomb sandwich.

All fuselage skins are chemically milled to provide light sheet with adequate land areas for rivet attachment. Chemical milling starts with a .063-in. sheet to provide for land areas of this dimension and etches the material down to an average thickness of .030 in.

Milled Spars

Wing structure is somewhat similar to that used on North American F-100 and F-107. Front and rear spars are milled, with webs varying from .070 in. inboard to about .040 in. outboard. Rear spar web inboard, used to support landing gear, is about .125.

Basic wing ribs are sheet metal, hydropress formed. Machined units

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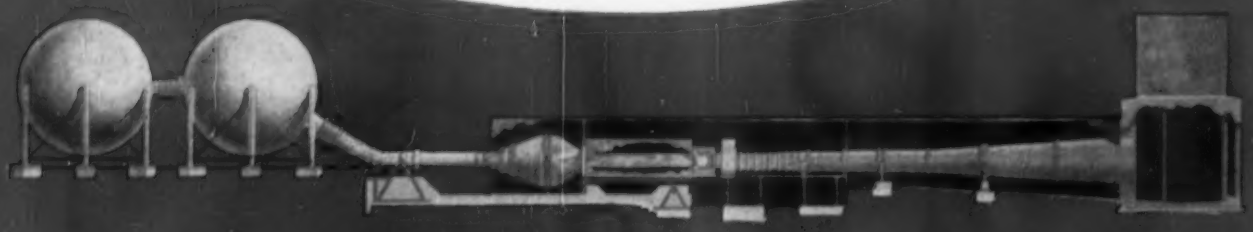

by

PDM
ENGINEERS · FABRICATORS · CONTRACTORS

Pittsburgh-Des Moines

Developing air velocities four times the speed of sound, Boeing Airplane Company's recently-completed test facility at Seattle joins the long list of wind tunnels built by Pittsburgh-Des Moines for private and governmental agencies over the past 21 years. The Boeing wind tunnel is of blowdown design, with air blast furnished by two 38 ft pressure spheres through a variable flow-forming nozzle to a 4 ft x 4 ft test area. A feature of the tunnel is its telescoping model-holder section for ease of setting-up test units. ● For experience, craftsmanship and responsibility in wind tunnel construction of every type, *consult Pittsburgh-Des Moines.*

Exterior view of test section and supersonic nozzle

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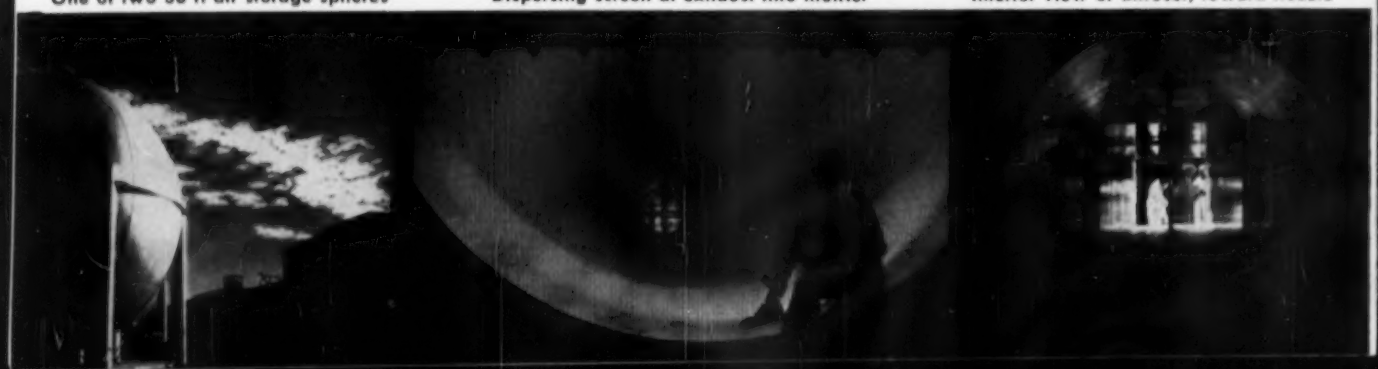
One of two 38 ft air storage spheres

Dispersing screen at exhaust into muffler

Interior view of diffuser, toward nozzle



include outboard rib at end of wing box, inboard rib of outer panel, outboard rib of center section and rib on airplane centerline.

Integrally stiffened wing skins are single sheets of 7075T-6 smooth tapered from about .070 in. inboard to about .040 in. outboard, the same as spars.

Scheme for sealing integral fuel tank is same as that used on F100-C, -D and -F. Wing boundary members—front and rear spars and end ribs—have a milled groove to accommodate sealing compound. At locations where the skin is fastened to the frame structure, this groove is locally widened by spotfacing to provide a continuous path for sealing compound around the fastener. Sealant (Thiokol putty) is injected, through small holes located near every third bolt, after the wing box is assembled.

Injection hole is filled with a self-tapping screw to retain the sealant. This sealing procedure gives a continuous barrier against leakage of fuel from the integral tank.

Cockpit Instruments

All units on cockpit panel are readily visible from each seat. On pilot side, instrument panel has Machmeter, sensitive airspeed indicator, Collins Flight Director, turn-and-bank, altimeter, radio magnetic indicator, rate-of-climb indicator and clock. Also, marker beacon lights, vertical gyro indicator, compass slave indicator, switch for testing fire warning devices, and landing gear position lights.

Instrumentation for each engine includes: exhaust gas temperature indicator, tachometer, fuel flow and oil pressure gage.

Radio panel in center has VHF transceiver, two VOR receivers, switching panel and automatic direction finder.

On copilot side there is fuel quantity test switch, fuel quantity gage (L & R), hydraulic pressure (L & R, dual instrument), flap position indicator, three trim-position indicators, cabin rate-of-climb, cabin pressure and differential pressure.

Another panel carries free-air temperature, emergency VHF transmitter, sensitive airspeed indicator, cross-pointer, attitude gyro, turn-and-bank, sensitive altimeter, RMI, rate of climb and marker beacon lights.

Engine controls are pedestal-mounted between the two seats.

Small overhead panel, located on underside of top window center frame, carries check lists for landing and take-off, electrical master switch, interior light switches, anti-icing controls and a caution-light panel which is keyed to master caution lights in front of pilot and copilot.

University Presents Space Law Lectures

University of California's University Extension will present a series of lectures on space technology in cooperation with Ramo-Wooldridge Corp. in Los Angeles, San Diego and San Francisco, beginning Jan. 13. Course is a three-unit credit if enrolled at either San Diego or Los Angeles. A bachelor's degree in engineering or science is a prerequisite. Series held in San Francisco is a non-credit lecture, although certificates of attendance will be awarded.

Aim of the series is to provide a sound exposition of fundamental principles of very long range ballistic vehicles, stressing those quantitative laws which are uniquely related to space flight.

Roster of lectures lists top authorities in their fields, including many laboratory directors, academic departmental heads and men with major responsibilities in the American satellite program.

Information on lecture topics and the various lectures may be obtained by writing University of California University Extension, Los Angeles 24, Calif.

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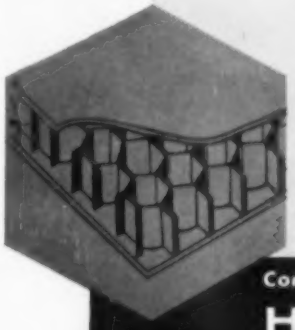

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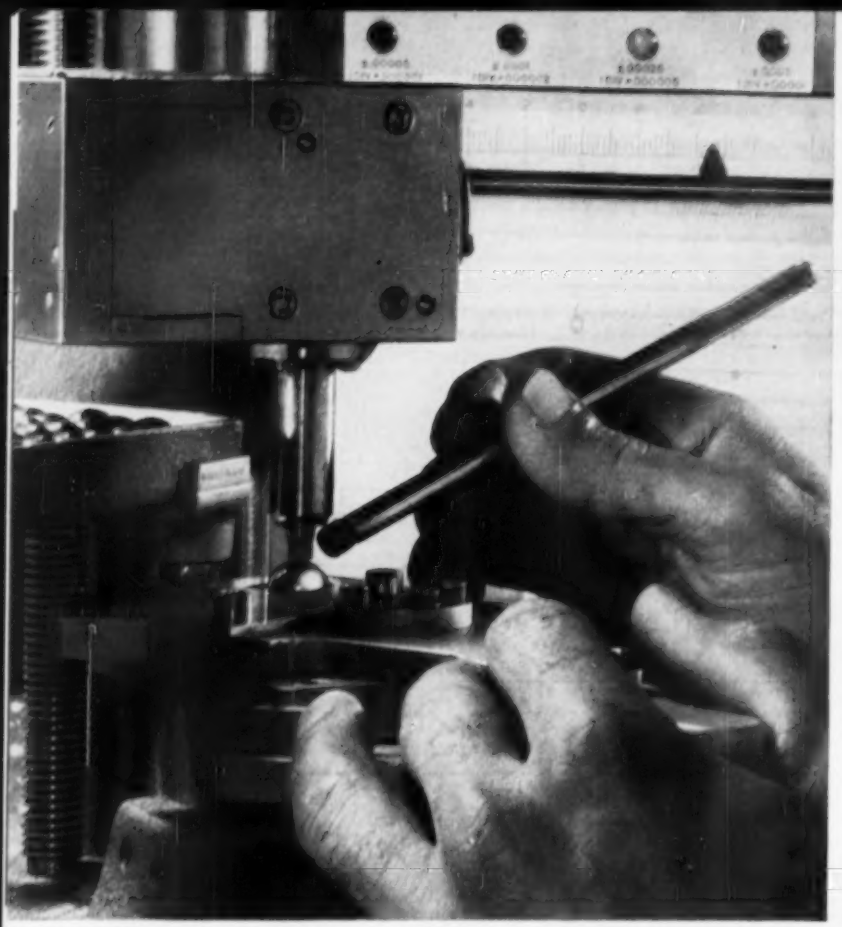
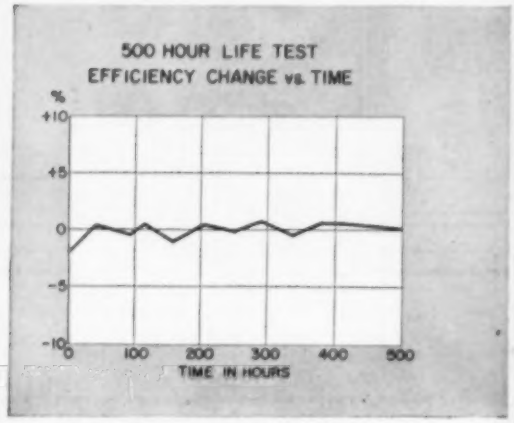


BALL PISTONS used in General Electric Hydraulic Constant Speed Drive show less than .000020 of an inch of wear after 500 hours of continuous operation. Wear is so minute a highly sensitive electronic device is needed for detection.

INNER DIMENSIONS of ball piston sleeve are well within tolerances after 500-hour test as shown by precision air gauge.



TEST DATA shows no measurable decrease in efficiency of G-E hydraulic constant speed drive after 500 hours of operation.

GENERAL ELECTRIC CONSTANT SPEED DRIVE TESTS SHOW

Ball Piston Drive Efficiency Maintained Throughout 500 Hours of Operation

Life test data shows no measurable change in efficiency of General Electric Hydraulic Constant Speed Drive after 500 hours of operation. The drive was operated in a typical aircraft speed and load schedule with inlet oil temperatures from 250° F to 315° F.

PRECISE INSPECTION of the ball piston units—key to the smaller size, lighter weight and mechanical simplicity of all General Electric Hydraulic Constant Speed Drives—shows why. After 500 hours of severe laboratory testing, the clearance between the ball pistons and their sleeves showed no significant change. Based on these findings, General Electric engineers predict that this same hydraulic constant speed drive could have been operated for an additional 500 hours with little or no loss in efficiency.

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☐ **Theory of Operation, GET-2480A**

☐ **Immediate project** ☐ **Reference only**

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Helicopter Stabilization Gains Test Hours

By J. S. Butz, Jr.

Bridgeport Conn.—Complete hands-off stability for helicopters provided through an electronic system has been found feasible and reliable in large scale use in over 60,000 hr. of operation in 200 Navy helicopters. Reliability of this electronic automatic stabilization equipment (ASE) is indicated by the fact that it averaged more than 200 hr. use without a crab (malfunction of any type) and more than 800 hr. without complete loss of the system.

The stabilization units receiving this tough service test were designed by the Sikorsky Aircraft Division of the United Aircraft Corp. and are being incorporated in all new Sikorsky helicopters for the Navy.

Weather Barrier

Hands-off stability has been the primary stumbling block to all-weather, 24 hour helicopter flying, which would more nearly realize the full potential of rotary wing aircraft. The stability and flying ease of helicopters has been greatly improved in the last 15 years through the addition of servos to reduce control forces and various mechanical changes in hub design. Despite very good progress in this area, helicopters have essentially remained unstable aircraft and a good deal of physical effort has been required from the pilot during all flight conditions.

Cumulative effect of this constant pilot effort plus the taxing character of instrument flight has kept bad weather and night flight from being routine with helicopters. Instrument flight is most unsafe during hover and at low forward speeds. For most military and civil operations instrument flight is still an emergency procedure.

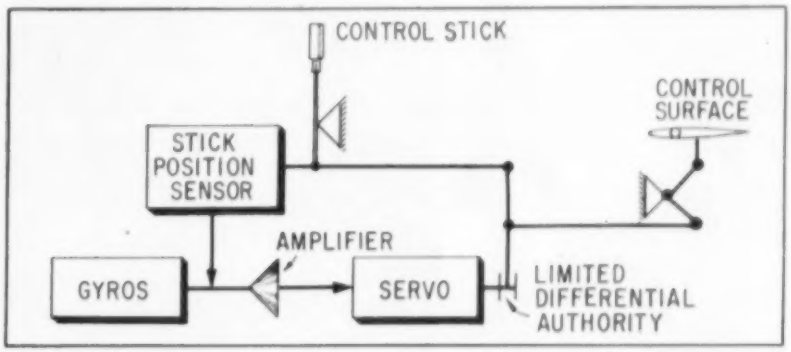
Automatic stabilization equipment has deflated the stability problem so that the helicopter is capable of being trimmed for completely hands-off flight at all forward speeds. Two general approaches have been taken to stabilizing helicopters.

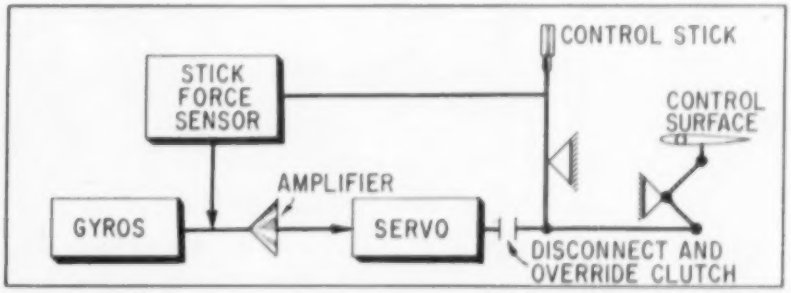
- **Completely mechanical** systems.
- **Electronic systems.**

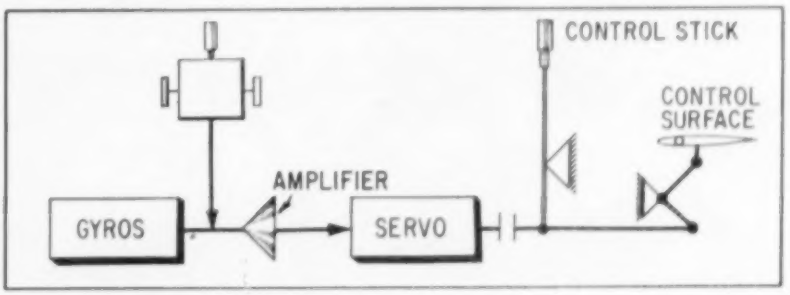
Electronic systems resemble auto pilots for fixed wing aircraft, but are more completely integrated into the helicopter control system. To date they have generally been more successful than the mechanical systems. Primary drawbacks of the electronic equipment has been its complexity and a concern over its reliability under operational conditions.

Results of service use of the Sikorsky system with only one complete failure of the unit recorded per 800 flight

SIKORSKY automatic stabilization equipment has been tested on HSS helicopters (above) for the Navy. Resembling autopilots, units are used constantly in flight. Lowest schematic (below) shows typical fixed wing autopilot, actuated by small secondary manual stick at left. Parallel type ASE (center) for helicopters eliminates this secondary control, main control moves during ASE operation. Sikorsky series type ASE (above) eliminates the control stick movement and gives the ASE only limited authority over the controls.







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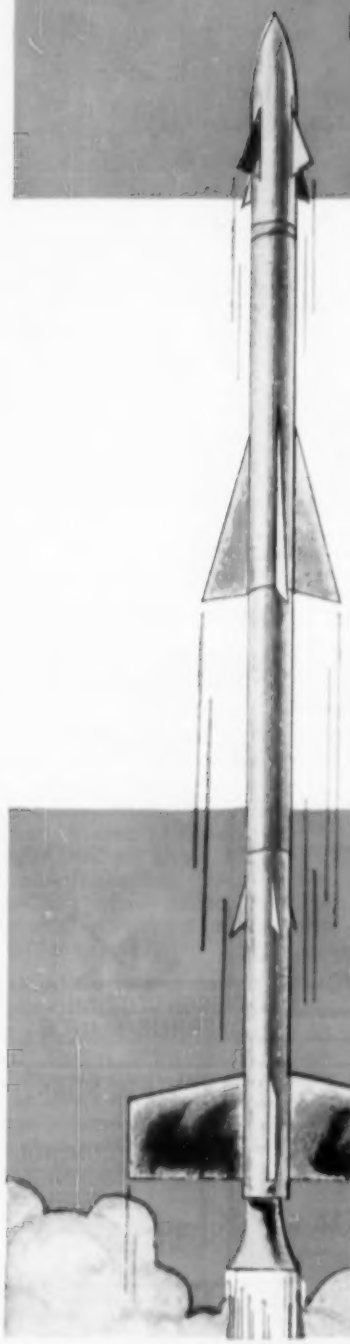

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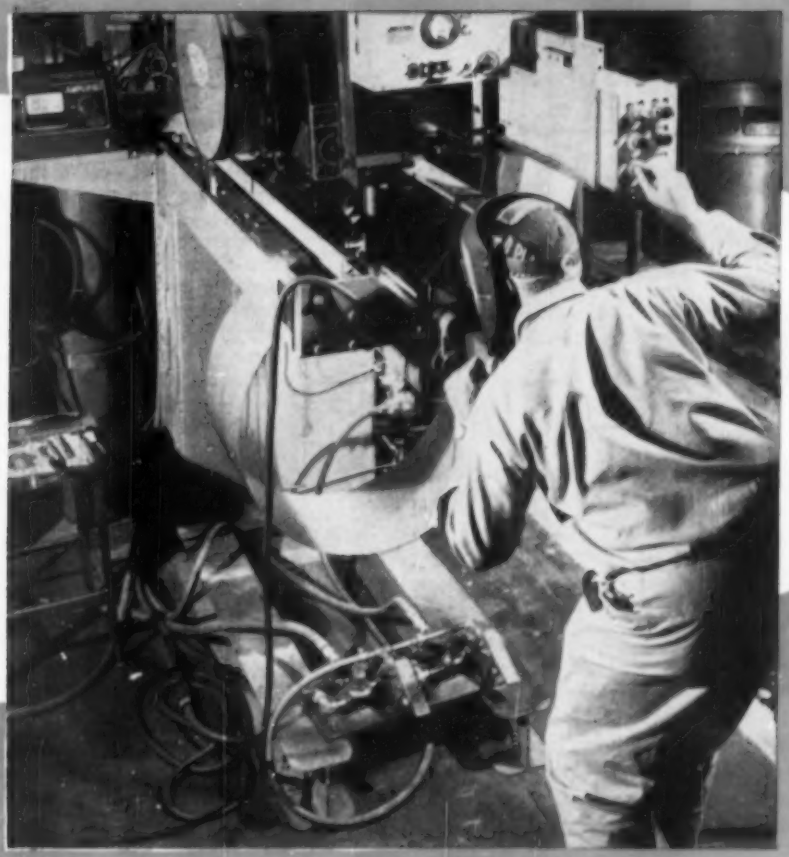

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hr. would seem a good record for a new electro-mechanical device of considerably complexity.

Sikorsky experience has shed some interesting light on electronic actuated controls in general. Sikorsky engineers say that their main design trouble with the system has not been with electronic but rather with the mechanical design and quality control of the rest of the system.

First source of system operational failure was relays, with mechanical maladjustments of the system next. Vacuum tubes proved much more reliable than they are generally given credit for, but they remain the hard core of unreliability. The other type failures encountered can be improved by better design, but vacuum tubes remain unpredictable. It is hoped that transistors will improve the situation.

General reliability of the system was proven in large measure because the Navy Bureau of Aeronautics directed all helicopter pilots to use automatic stabilization continuously if their helicopter was so equipped. The aircraft was to be grounded if the system did not function properly. This insured that automatic stabilization equipment would get a quick and thorough evaluation and that flying and maintenance personnel would become proficient in its use.

Pilot acceptance is reported to be excellent because of the system's fatigue reducing quality and its reliability.

Instrument Flight

The new and reliable stability that automatic stabilization equipment provides for helicopters means that full instrument flight is possible now with standard blind-flying instruments. New instrumentation is being developed to make this type of flight easier.

All helicopter operators stand to benefit greatly from this work. The Navy wants to use the helicopter, which has proven to be a very effective anti-submarine aircraft, on a 24 hr. schedule. The Army wants to insure helicopter transportation on a round-the-clock basis. It would eliminate forward medical stations, for instance. Commercial operators will have an all-weather passenger vehicle once twin-engine helicopters are available. Search and rescue operations will become more effective, to mention only a few of the possibilities of the stable helicopter.

Development of electronic automatic stabilization equipment has taken two paths, both different from a normal autopilot. The systems are an integral part of the normal helicopter controls. The most obvious difference to the pilot between the automatic stabilization systems and the normal autopilot are:

• **Autopilot** is controlled by a knob or

stick separate from the main controls of the aircraft.

• **Parallel type** automatic stabilization equipment moves the entire helicopter control system including the pilot's stick to maintain a given attitude.

• **Series type** automatic stabilization equipment does not move the pilot's stick as it keeps the helicopter in a given flight attitude.

Sikorsky's equipment is the series type, which requires much less power to operate than the parallel and is considered to offer a significant weight advantage for a single rotor helicopter. The Sikorsky system adds only 60 lbs. to the normal weight of the control system.

The Navy has specified that automatic stabilization closely resembling this system be installed on some of its new helicopters. However, in further development to perform more sophisticated functions a combination of the series and parallel systems will probably be used. Navy personnel, Sikorsky, and some other contractors are working on this combination.

Series Operation

To insure that the series system never puts the helicopter into some sudden, unusual and dangerous attitude it has limited authority over the control system. It can only move the cyclic control system through 10% of its total travel to retain any attitude that the pilot gives the helicopter. To maintain altitude, the system can move 13% of collective pitch travel. In yaw it can change the pitch of the tail rotor through 15% of its travel to maintain heading.

While malfunctions of the series equipment still occur and the system may give the controls a "hard-over" signal, it is well within the capability of the pilot to correct it.

Until recently autopilots and similar equipment were furnished to airframe manufacturers by the government and the airframe builders were not responsible for the performance of these units. Sikorsky developed its automatic stabilization equipment as a part of its obligation as prime contractor on the HSS helicopter. This met with some opposition from instrument makers. However, the Sikorsky design used servos, gyros etc. purchased from instrument and equipment manufacturers to Sikorsky specifications.

The very intimate relationship between the helicopter, its control and its automatic stabilization equipment made development by the prime contractor seems attractive.

It worked in the HSS case as indicated in operational use. It may lead to even greater responsibility for the prime contractor in helicopter purchases by the government.

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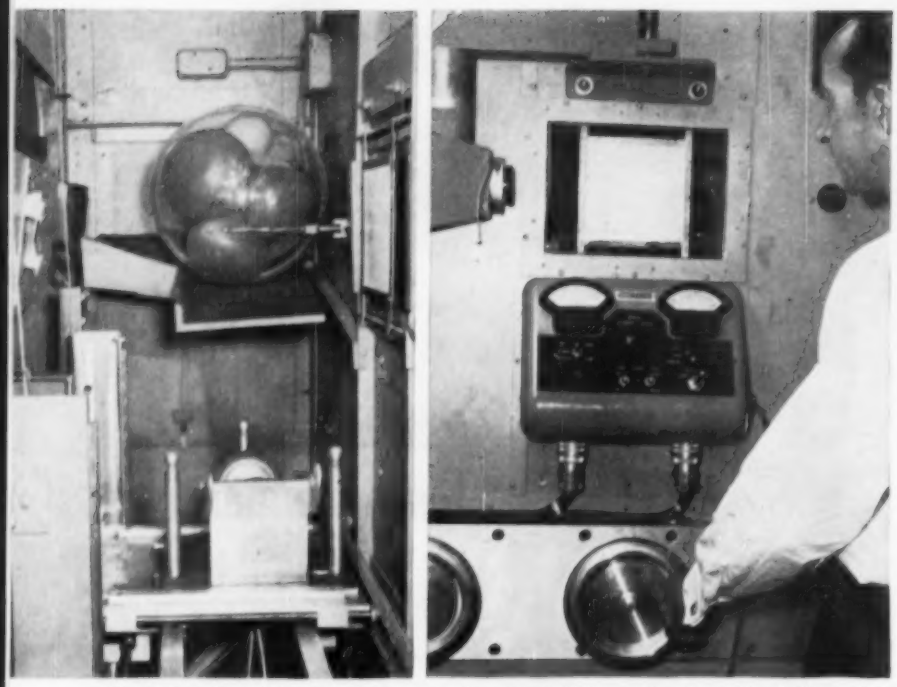


PLASTIC sphere (left), containing a metal casting held in position by rubber balloons, has just rolled down chute to movable platform which holds casting between fluoroscope and viewing screen in control cab (right). Cab is shielded to protect operator from radiation. Camera at left of viewing screen can be swung around to photograph fluoroscoped casting.

Fluoroscopic Castings Inspection Spots Gas Holes, Sand Inclusions

Dallas—Fluoroscopic inspection of magnesium and aluminum castings has been evaluated for the Navy by Chance Vought Aircraft, Inc., and the company has found that fluoroscopy can be used to replace or reduce use of X-ray inspection.

In its report to Naval Ordnance Laboratory, Chance Vought recommended that fluoroscopy replace X-ray on a 100% basis for certain castings, and the test program indicated that this process may also be valuable in inspection of stainless steel brazed honeycomb material.

Chance Vought has been testing a high intensity fluoroscope for the Navy since February, 1956. The machine was developed by Naval Ordnance Laboratory, and the company operated the evaluation program at the request of Bureau of Aeronautics.

Fluoroscope Layout

Fluoroscope was installed in a booth layout for Chance Vought's test program. Castings are put in plastic spheres and rolled down a chute to a movable platform which holds the casting between the fluoroscope and the viewing screen in the control cab. The casting can be rotated by remote control from the control cab and thus can be inspected from all angles. Castings are removed through a second chute when the inspection is completed.

Control cab is shielded to protect the operator from damaging radiation. Cab contains instrumentation for the fluoroscope and controls for moving the castings. Cab is also equipped with a camera which can be swung in front of the viewing screen to photograph the fluoroscoped casting.

Test Program

Two tubes were used in the test program—the Super Dynamax, Focal spot 1 mm, 900 KVP-MA and the Special High-power Machlett tube, Focal spot 0.5 mm., 4,000 KVP-MA. Screen was the Radelin F with an unsharpness measurement of 0.5 mm., and power supply was a General Electric transformer with 2,000 KVP-MA rating. System also has a stepless voltage control, and milli-amperage is automatically adjusted to maintain constant power output to the tube.

Clear plastic spheres are used to hold the castings. Small rubber balloons are

Aeroquip

Engineering Notes

B. A. MAIN, JR.

The Aeroquip 3200 Self-Sealing Coupling described in the advertisement at the right is designed to meet the new military specification MIL-C-25427. This specification requires the coupling to be arranged so that if it is not fully connected and locked, it will automatically snap apart.

Since we wanted a coupling which could be connected against pressure that might be present in an hydraulic system, we chose to use a quick-lead thread as the connecting means. The angle of this thread is such that the valve springs will easily push the coupling halves apart if the connecting nut is not turned far enough to be fully locked. These threads also provide sufficient mechanical advantage to permit the coupling to be connected even though the system is under pressure.

The fast lead used in this device requires the locking mechanism to be capable of withstanding a large proportion of the separating force developed between the coupling halves under system pressure. While this load on the locking device is not unduly severe on the smaller sizes of couplings, it does grow to appreciable proportion on the larger sizes such as the -12 and -16. So it is wise to consider the full range of sizes when evaluating a coupling design of this type.

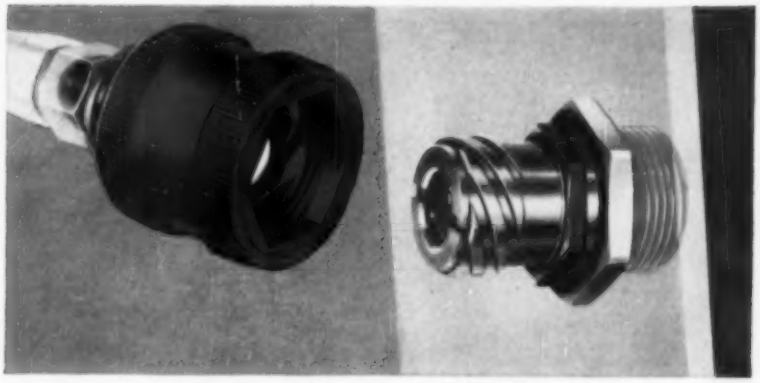
The new military specification assumes the couplings will be used in the connected position only. Our experience has indicated that it is often advantageous to use hydraulic couplings as separate halves for test and also service. Therefore, we have designed the Aeroquip coupling so that either half will meet at least 50,000 cycles of the impulse and vibration test.

To sum up then, the Aeroquip 3200 Self-Sealing Coupling will snap apart if it is not fully locked when connected. It can be connected against pressure. The motion for connecting and disconnecting are exactly the same through the full range of sizes. The halves can be used separately at full system pressure. And, the 3200 Self-Sealing Coupling is available with either MS or AN standard tube connection.

B. A. Main Jr.

VICE PRESIDENT, ENGINEERING
AEROQUIP CORPORATION

AN AXIAL PULL ON THE UNION NUT DISCONNECTS THE COUPLING. There is no loss of fluid, even when systems are pressurized.



COUPLING HALVES SPRING APART WITH VALVES CLOSED. Each half remains sealed perfectly until coupling is reconnected.

A QUARTER TURN OF THE UNION NUT CONNECTS COUPLING HALVES assuring full flow of fluid. There is no air inclusion. Visual or manual check for locked position is made by observing position of locking hex, by attempting to turn the union nut, or by tugging on the attached hose line. The coupling cannot unlock accidentally during normal service.

Fast Acting !

Aeroquip 3200 Series Self-Sealing Coupling

FOR 3000 PSI. SYSTEMS

- **SAFE** . . . may be checked visually or manually for locked position.
- **SIMPLE** . . . valves contain only 2 moving parts.
- **FOOLPROOF** . . . there is no stable intermediate position where the coupling is partially open and unlocked.
- **NO FLUID LOSS** . . . the Aeroquip design prevents fluid loss during connection and disconnection.
- **NO AIR INCLUSION** . . . the coupling cannot admit air into the fluid system during connection and disconnection.
- Designed to meet the requirements of military specification MIL-C-25427.

Return the coupon below for Aircraft Engineering Bulletin AEB-17 giving technical information.

Aeroquip Corporation,
Jackson, Michigan

AW-12

Gentlemen:

Please send me your Bulletin AEB-17 on 3200 Series Self-Sealing Couplings.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Aeroquip

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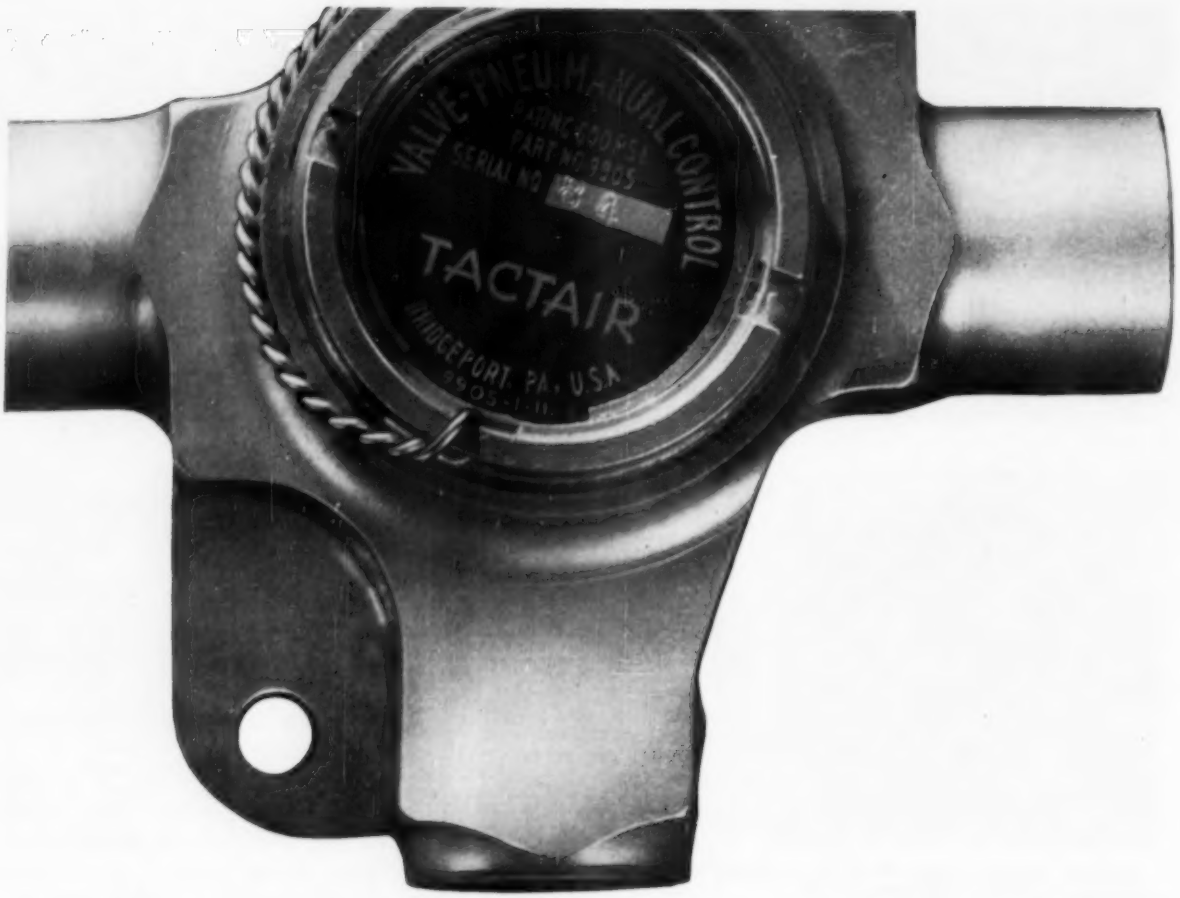


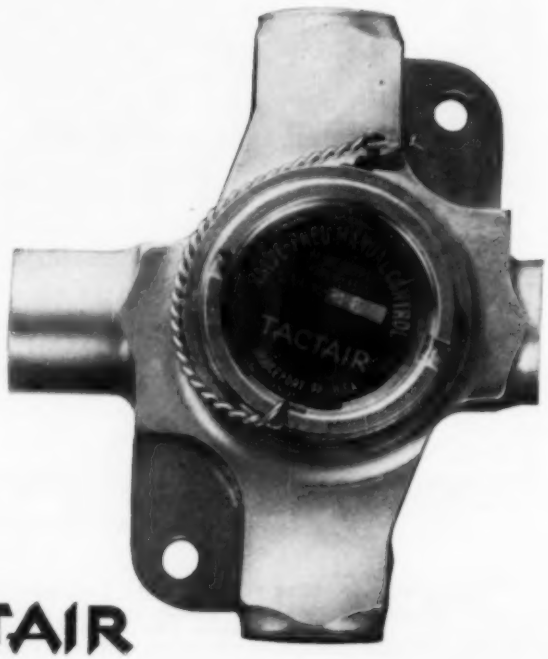
Note: to precision-minded men at McDONNELL

Tactair valves surpass the tightest requirements of manufacturers and the Armed Forces on civil and military aircraft. One reason is custom design in close cooperation with your engineers. Another is the fact that every sixth employee at Tactair works on quality control.

Case in point: this miniaturized 4-way pneumatic selector valve with non-interflow characteristics. Tactair engineering gives it essential compactness and light weight. It has very low leakage, positive operating stops, unusually low operating torque at full pressure, and a unique safety torque override.

Results: substantial saving of space and weight in aircraft—plus dependable performance under critical conditions—both at a realistic price.

Reminder: on standard or special components, we welcome a chance to assist you with your next precision valve problem. Every job we do is done on a personalized basis and backed by our warranty of responsibility. It has been that way for 16 years. Tactair Valve Division, Aircraft Products Company, Bridgeport, Pa. BRoadway 5-1000.



CONTROL, SELECT, BRAKE, RESTRICT, CHECK... with TACTAIR

CASTING rests on balloons in plastic hemisphere; demonstrator shows how three more balloons are positioned to suspend casting.

employed to suspend the casting inside the sphere. System will handle items up to a maximum size of 12 in. When the machine was designed in 1951, it was found that 95% of castings used fell in this size range, and today probably 80% are still in this category.

During the evaluation, Chance Vought inspected 2,000 production aluminum and magnesium castings to get a comparison between X-ray and fluoroscopic techniques. All castings tested had been previously X-rayed, and X-ray-rejected castings were scattered through the test lots so the fluoroscope operator didn't know the X-ray evaluation of the castings he was inspecting.

Cost analysis of the two techniques was made by timing fluoroscope inspection of 10 castings, then multiplying by two, since two operators are required to work the system. Costs cited in Chance Vought's report show charges of 14-18 cents for fluoroscopy, while costs of X-raying the same castings ranged from 80 cents to $1.96.

Better Than X-Ray

Chance Vought also inspected 150 pitot tubes for sealant contamination of voids in the tubes. Company found fluoroscopy more effective than X-ray for the job and noted that fluoroscopic inspection could be accomplished while the tubes were in their shipping cartons.

Among disadvantages of the system, Chance Vought listed the fact that the plastic spheres used are fragile and break easily. C. R. McChesnee, metallurgical engineer in charge of the program, notes that an operator can inspect about 70 castings an hour with the present plastic sphere technique. He estimates that 100 castings could be inspected in an hour with an improved handling technique—maybe a set of remotely controlled hands similar to those used in atomic research.

During the tests, 58 of the 121 castings rejected by X-ray were also rejected by fluoroscopy. The remaining 63 castings rejected by X-ray had microshrinkage which couldn't be detected by fluoroscopy. But fluoroscopy also rejected 129 castings not rejected by X-ray. These castings had gas holes and sand inclusions that X-ray had missed.

Chance Vought is now installing a new Dynamax 150W tube supplied by Machlett Laboratories to give the system capability of detecting microshrinkage. Test program will be finished in about three months, after Chance Vought has run 1,000 castings through with the new tube.

As a result of the test program, Chance Vought reported that fluoroscopy can be widely used to replace or reduce X-ray inspection. For Class 1A, Mil-C-6021 castings, it is recommended that fluoroscopy be used on a 100% basis, but that X-ray be used on a 10% sample of the castings as a means of double checking. Report recommends a complete switch from X-ray to fluoroscopy for Class 1B, Mil-C-6021 castings.

No extensive testing was done on stainless steel brazed assemblies, but work done indicates that fluoroscopy would be superior to X-ray inspection for this type of material.

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Typical example of facilities for meeting your requirements for precision manufacturing in either the production or prototype phases of your programs.

Specially built Ram-Turret Vertical Mill with three dimensional Hydraulic Attachment machining a component. This versatile machine uses a Tracer Stylus to follow a "Contour Master" and will duplicate complex contours and shapes in minimum time. The Turret has two heads; one for universal milling (any angle) and the other for vertical shaper attachment for broaching, precision serration, etc.

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HERE AT LAST – THE IDEAL FIELD ATTACHABLE FITTING:

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WILL PERFORM AS DEPENDABLY AS IF FACTORY ASSEMBLED

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Easily assembled – flared skirt on socket protects hose and hands.
Needs no special skills – no torque wrench required.
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Nose Cone Will Be Army Satellite

Pasadena, Calif.—Army's planned satellite (AW Nov. 25, p. 31) will not separate from the last stage rocket after launch by a slightly modified version of Army's Jupiter C multi-stage ballistic missile test vehicle.

Dr. William H. Pickering of Jet Propulsion Laboratory, California Institute of Technology, reported that the satellite's launching is scheduled for sometime between the first of the year and the end of March.

Pickering said Jet Propulsion Laboratory has assumed a role in the Army program equivalent to that played by the Naval Research Laboratory in the Vanguard program. Jet Propulsion will adapt the final two rocket stages to the satellite launching task and will modify the satellite instrument package to fit the rocket.

Instrumentation potted in shock absorbing foam plastic will be formed to a bullet shape to fit within the steel nose cone of the final rocket stage. Effect on instruments of heat transfer from rocket motor and desire for uniform visibility regardless of visual angle which led Vanguard scientists to choose a separated, polished sphere are not considered important in the Army-Jet Propulsion Laboratory project.

Instrumentation in the Jupiter-launched satellite was formerly Package 2 in Vanguard program. Main experiment is a cosmic ray study by the State University of Iowa under the direction of Dr. J. A. Van Allen.

It will be replaced in the Vanguard program by a study of the earth's radiation balance by the University of Wisconsin. Package 2 weighs about 20 lb., will be slightly over 12 in. long. Its average diameter will be about seven inches.

The Army satellite will carry two

C-130 Makes Rough Field Landing

Lockheed C-130, being tested by the Air Force at Eglin AFB, Fla., cuts a 14-in. ditch in sand during a rough field landing demonstration. Weight of the aircraft was 103,000 lb. Though the Hercules was designed for short, hastily prepared airfields, it was not originally intended to land on this type of terrain.

Part No. AF56C-15
O.D. 1.25 in.
Wt. 6 oz.
Minimum internal leakage.
All-metal parts—Teflon seat.

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In reply please address Dept. 00

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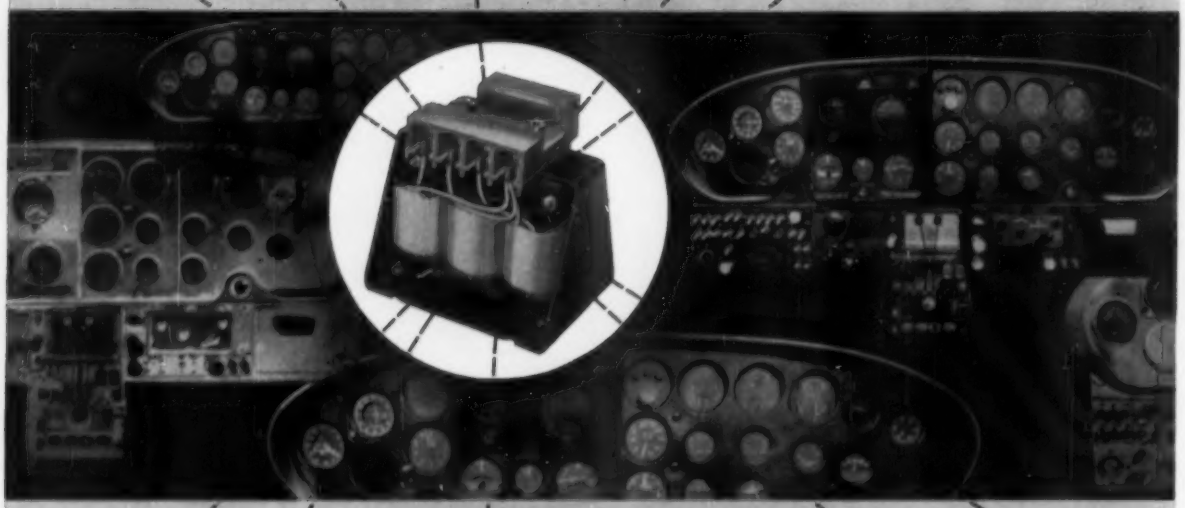

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Constant, dependable power is a must for lighting, instruments, controls, rectifiers, window-heating, and other functions in commercial and military aircraft A-C systems. Combining full power ratings with minimum size and weight, the Westinghouse aircraft power transformer provides efficient control of this distribution voltage.

Reduced size and weight is achieved by a combination of Class H insulation and continually improved Westinghouse grain-oriented Hipersil® steel for cores.

Easier installation and maintenance are assured by molded terminal boards and covers. This feature provides an additional weight reduction, too.

Peak cooling efficiency results from the open-type construction, which also eliminates weighty housings and filling compounds.

This transformer meets all environmental, overload, regulation and efficiency requirements of Air Force Specification MIL-T-9219, as well as the most rigid individual requirements. It is rated at 1½-kva, 3-phase, 380-420 cps, 200/115 volts, full load.

Contact your Westinghouse representative, or write Westinghouse Electric Corporation, Specialty Transformer Department, P. O. Box 231, Greenville, Pennsylvania.

J-70827

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transmitters. One will be the standard Vanguard transmitter with an output of 100 milliwatts that can be received by the Minitrack network and by amateur radio operators. Signal is expected to last for two or three weeks. The second will be Jet Propulsion Laboratory's Microlock system also transmitting on 108 mc. but at a power of only 10 milliwatts. Low power level and long range are obtained by using bandwidth of only a few cycles.

Because of low power requirement, Microlock transmitter is expected to send for several months. Amateurs will be unable to pick up the signal because of the unusual receiver sensitivity needed. Microlock receiver uses phase lock system to get this sensitivity. U. S. will build a network of these in several countries. Microlock system was designed about a year ago. Transmitter weighs one-half pound; batteries weigh one and one-half pounds.

A later Army launching may put up a 1,000 lb. satellite. Redstone first stage and Thiokol Recruits in second and third stages would be replaced by production configuration of Jupiter and Sergeants in second and third stages.

Britain Reviews Aircraft Programs

London—British defense officials now are carrying out a thorough review of the nation's military aircraft program.

The Ministry of Defense says the review is designed to keep the number of British aircraft projects to the minimum consistent with security.

This is stated in reply to a House of Commons subcommittee which last January severely criticized British aircraft procurement methods (AW Jan. 28, p. 26). Research and development facilities are being studied with the object of merging establishments wherever possible, it is said.

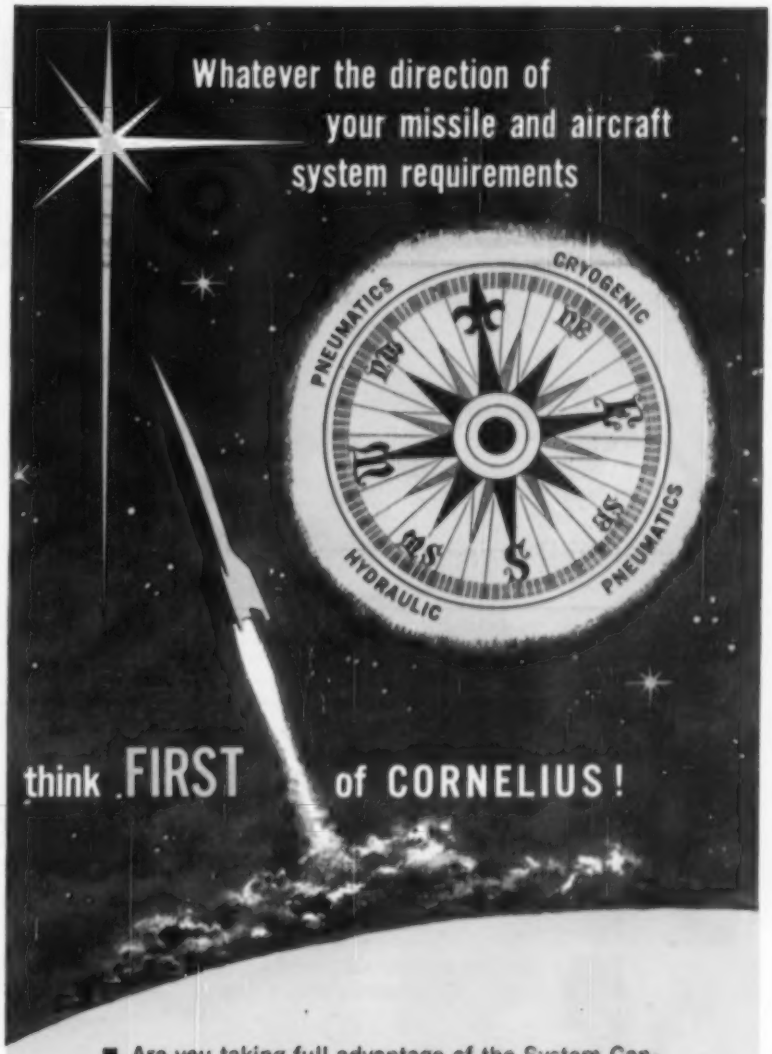
The review is also being undertaken due to changes in defense programming outlined in last February's White Paper. A defense of past British aircraft procurement policies is put forward in the replies.

Noting committee criticism of what it regarded as an extraordinary numbe of helicopter projects, the Ministry of Supply replies:

"No work on helicopters had taken place in the United Kingdom during the war so that a good deal of leeway had to be made up if any service and civil requirements were to be met with British designs."

It said that of the 10 helicopter projects referred to by the committee, three have been abandoned, four have resulted in production aircraft and three are still under development.

The subcommittee strongly criticized



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Bill Remmert brought R-W services to Pompano. Behind him, a DC-3 conversion nears completion.

Bob Werner works most of his time at Remmert-Werner's home-base operation in St. Louis.

Remmert-Werner...
Big-Change Artists

Over 200 aircraft conversions . . . thousands of corporate planes maintained and serviced . . . millions of gallons of Shell Aviation Fuel sold to satisfied customers—that's Remmert-Werner's 10-year record!

In June '56, a caravan of three giant mobile units left Remmert-Werner's home base, Lambert-St. Louis Municipal Airport. It was headed for Pompano, Florida.

Bill Remmert met the caravan. Utilizing its complete machine, woodworking, and electrical shops plus radio racks, stockroom and expert mechanics, he established another R-W-staffed base.

"When we took over the Pompano field," recalls Bill, "we needed fueling equipment—fast. Shell engineers came down and designed our bulk plant. And almost before we knew it, there were the three 15,000-gallon storage tanks we ordered waiting out there on flatcars, ready to go. Shell helped us zoom into business."

Besides servicing a good number of America's 28,000 corporate planes, Remmert-Werner also converts surplus commercial and military aircraft into luxury planes for private owners and corporations.

In an ordinary conversion job, R-W rips out every bit of wiring and piping, and installs completely new systems to customer specification. Lounge chairs and sofas, tables, lamps, galleys and any other special furnishings are designed and built by R-W craftsmen.

Among the organizations that happily fly Remmert-Werner conversions are Olin Mathieson Chemical, Grumman Aircraft, Hercules Powder and Owens-Illinois Glass.

"It didn't take long for us to find out that when you're a Shell Dealer, business flies your way," says Bill. "Shell works right along with you, helping you build your business. They've even helped us locate old DC-3's when they've been hard to get. A Shell man spotted some while traveling in Turkey last year. We went right over there and bought them. Most of those '3's' have already been converted into flying yachts."

If their first 16 months at Pompano is any indication, Bill Remmert and Bob Werner are on their way to making R-W service available to America's ever-increasing fleet of corporate aircraft.

Before: C. S. Weaks (right), R-W sales manager, and client discuss plans for a Grumman "Goose."

After: R-W serviceman fuels a converted "Goose" with Shell Aviation Gasoline.

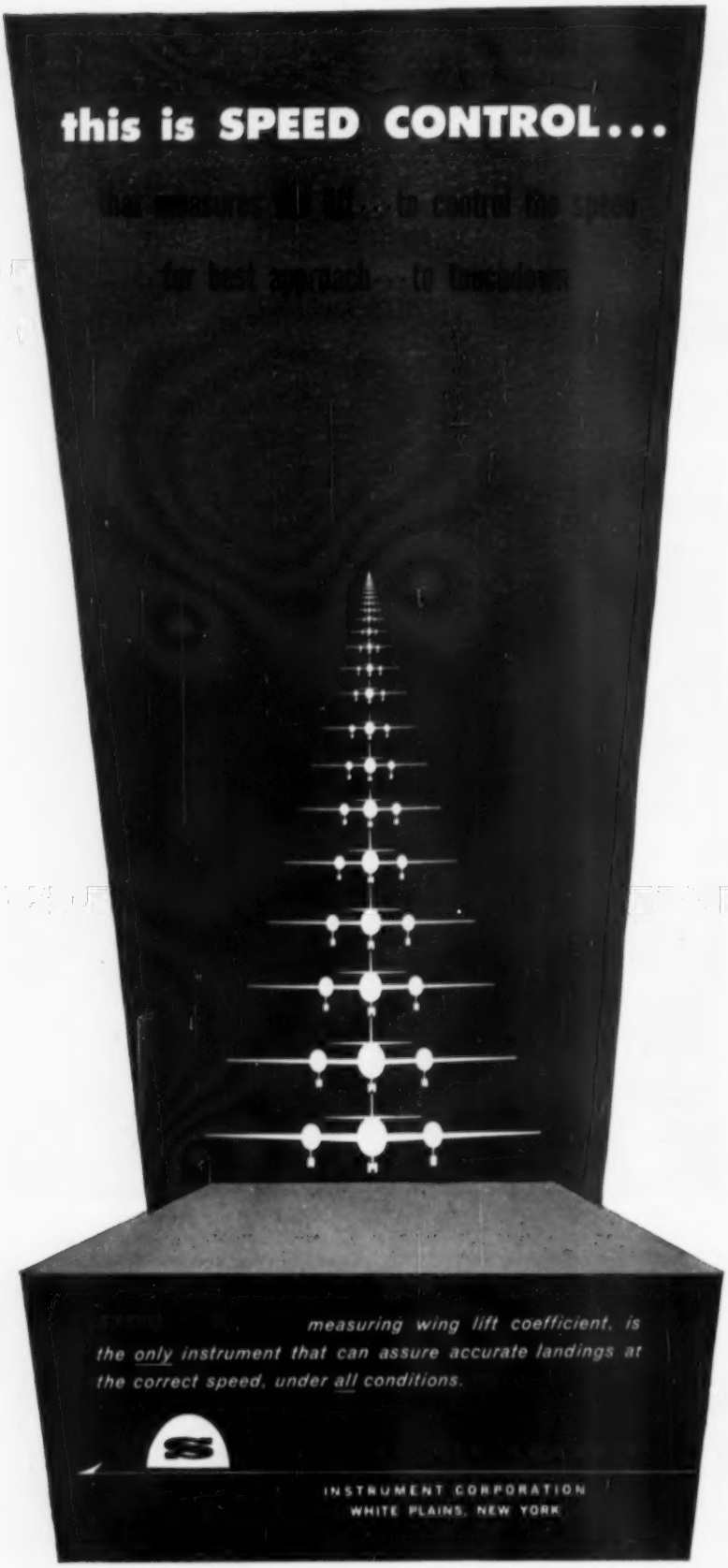
Before: R-W craftsmen remodel interior of DC-3. They'll install new wiring, insulation, picture windows, and furnishings to order.

After: Betty Remmert (right) shows prospective client through completed interior. R-W conversions sell for as much as $300,000.

It pays to be a Shell Aviation Dealer

—and the Shell office nearest you will be glad to show you why

SHELL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the only instrument that can assure accurate landings at
the correct speed, under all conditions.
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waste in the Supermarine Swift program, labeling the aircraft a $92-million failure. Of this charge the Ministry of Supply says:

"The Swift was a failure in the sense that it proved impossible to develop the aircraft to an acceptable performance in the main roles for which it was required within an acceptable time. During 1952-1955 troubles encountered in development were not obviously greater than those normally met in the development of an advanced aircraft and it was expected that they could be overcome within a reasonable time. Moreover, during most of the period the difficulties encountered in the development of the Hunter seemed, if anything, to be the greater.

"Orders for Mk. 1s and 2s were reduced to very small numbers by the middle of 1953, when it was clear that these aircraft would not fully meet the operational requirements."

The Ministry says orders for Mk. 3s, 4s and 6s were canceled in February, 1955. As soon as flight tests had shown that these could not be brought to an acceptable standard without more extensive development than could be justified in the circumstances. It notes that the Mk. 5 is in service as a reconnaissance aircraft.

The Ministry says it has now adopted the "development batch" system of the U. S. Cook-Craigie plan, crediting this as one reason why American fighter development is ahead of Britain. The Ministry insists that bomber development in the two countries takes about the same time.

Meanwhile, three prominent members of the aircraft industry have put their views about the effect of defense reductions before the parliamentary and scientific committee of the House of Commons. They are Dr. A. E. Russell, director and chief engineer of Bristol Aircraft. H. G. Nelson, managing director of English Electric and Sir William Farren, technical officer for A. V. Roe.

Dr. Russell suggested that in view of the phaseout of fighters and bombers, substantial government support is needed to prevent the industry from falling behind in the development of civil aircraft.

Regarding British plans for a supersonic airliner, he said it is possible that an economic solution may be found not at low supersonic speed but at speeds in excess of Mach 2.

Nelson suggested a new government agency be set up to administer a national policy for civil aviation.

Farren disagreed with those who have written off the future of manned aircraft in favor of the guided missile. "I recognize," he said, "that there will be fewer of them than formerly but their variety will be greater."

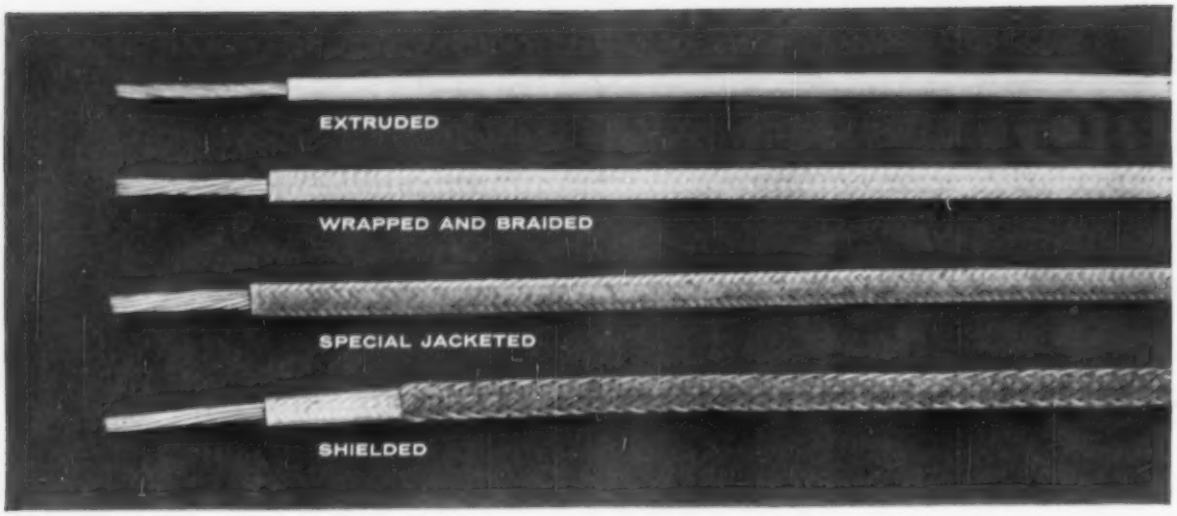
PHOTO at right shows a procession of flight students marching in the Nov. 7 parade in Red Square, Moscow.

Russians Display Ground Forces, Weapons

Russia exhibited several new types of ground equipment at the Nov. 7 parade in commemoration of the 40th anniversary of the Bolshevik revolution. These photos show some of Russia's ground force armament, as displayed in Moscow's Red Square. Photos of Soviet rockets and IRBMs appeared in Aviation Week, Nov. 18, p. 29. Conventional weapons in the Russian arsenal include self-propelled 57 mm. guns capable of being transported by heavy cargo helicopter, heavy tanks armed with 122 mm. guns, full-tracked 240 mm. rocket guns capable of a range of five miles, a howitzer 10 times faster than its predecessor and large mortars that may be able to fire atomic shells. Perhaps the most significant development is a 12-ton-payload helicopter, the Mil-6 (AW Nov. 11, p. 30).

SOVIET mobile ground equipment shows definite improvement over weapons used in World War II. Note missile being transported on truck in left background.

FLIGHT students at left are same as in photo at top right. Paratroopers are shown at right; they are armed with new automatic pistols.



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MILITARY SPECIFICATION	TYPE, GRADE AND CLASS OR O.D.	THERMALS	PACKARD TYPE OR SPEC. NO.	VOLTAGE	CONSTRUCTION					REMARKS
					CONDUCTOR	INSULATION				
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	E	500°F CABLE	PE-160-E(E)	600	SILVER PLTD. COPPER	EXTRUDED TEFLON				HIGH TEMPERATURE – COLORS AVAILABLE
MIL-W-16878/6A	EE	500°F CABLE	PE-160-EE(B)	1000	SILVER PLTD. COPPER	TEFLON TAPE	GLASS BRAID	TEFLON ENAMEL (COLORS AVAILABLE)		HIGH VOLTAGE – HIGH TEMP. – ULTRA HI FREQ.
	EE	500°F CABLE	PE-160-EE(E)	1000	SILVER PLTD. COPPER	EXTRUDED TEFLON (COLORS AVAILABLE)				HIGH VOLTAGE – HIGH TEMP. – ULTRA HI FREQ.
MIL-W-7139A	TEFLON	500°F	PE-400	600	SILVER PLTD. COPPER	GLASS REINFORCED TEFLON TAPES AND FILMS				SINGLE AND MULTIPLE CONDUCTORS–COLORS
	TEFLON	500°F	PE-400-S	600	SILVER PLTD. COPPER	GLASS REINFORCED TEFLON TAPES AND FILMS, SILVER PLATED COPPER SHIELDED				SHIELDED
NO MIL. SPEC.	TEFLON	–	PE-410	600	SILVER PLTD. COPPER	INSTRUMENT "HOOK-UP" CABLES OF VARIOUS CONSTRUCTIONS				SMALL O.D. CABLE – SEE CATALOG SHEETS
NO MILITARY SPECIFICATION ISSUED	5MM	500°F CABLE	58410-R		PLTD. COPPER	TEFLON	GLASS BRAID	TEFLON ENAMEL		HIGH TENSION IGNITION, COPPER
	7MM	500°F CABLE	58410-R		STAINLESS STEEL	TEFLON	GLASS BRAID	TEFLON ENAMEL		HIGH TENSION IGNITION, STEEL
	5MM	500°F CABLE	58411-R		STAINLESS STEEL	TEFLON	GLASS BRAID	TEFLON ENAMEL		HIGH TENSION IGNITION, STEEL
	7MM	500°F CABLE	58412-R		PLTD. COPPER	TEFLON	GLASS BRAID	TEFLON ENAMEL		HIGH TENSION IGNITION, COPPER
	–	500°F CABLE	PE-410, 58065-R		7 X 6 S.P.C., 1 STEEL	TEFLON	GLASS BRAID	TEFLON ENAMEL		LOW TENSION IGNITION – ROPE LAY
	–	500°F CABLE	PE-410, 56979-R		SILVER PLTD. COPPER	TEFLON	GLASS BRAID	TEFLON ENAMEL		LOW TENSION IGNITION
		400°F CABLE	PE-410, 66706-R		SILVER PLTD. COPPER 7 X 5 SPC 2 STEEL	TEFLON	GLASS BRAID	DACRON BRAID	HIGH HEAT LACQUER	LOW TENSION IGNITION – ROPE LAY

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Teflon insulation, for example, was used in its earliest forms in Packard cable. Now Packard cable is available with extruded Teflon and with one or more wraps of Teflon film and glass-supported Teflon tapes sintered. It can be furnished in various colors, shielded and/or braided.

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For your convenience, Packard Electric maintains branch offices in Detroit, Chicago and Oakland, California.

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USAF Expert Proposes Future Devices

By James A. Fusca

Utica—Radically new components and techniques required to meet Air Force needs of 20 years from now were suggested here by one of USAF's top communications experts, Dr. Joseph H. Vogelman, head of the Directorate of Communications of Rome Air Development Center.

Dr. Vogelman told engineers attending the Third Aero-Communications Symposium that he wanted to stimulate new ideas in development of USAF communications equipment by extrapolating technical advances now in the research phase to equipment of the future.

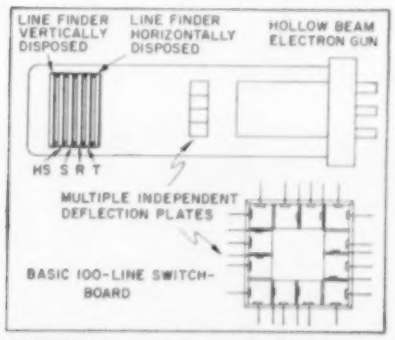
Dividing the subject into two parts, he first described the characteristics of certain special components to be developed and then the equipment that could be created with these special components.

New Components

Though the future will create a continuing demand for new components, a requirement that will not change is that both new and existing components be made smaller, more reliable, more efficient, operate at higher frequencies and be less expensive.

Requirements for certain of these special components to be developed are:

• **Low-loss,** high permeability, ferrite-like materials. Phase velocity of electromagnetic waves in the material should be a function of frequency such that a quarter wavelength plate of the material is exactly a quarter wavelength over a very wide frequency band. Subjected to magnetic field, phase shift should remain constant over a wide frequency range.



ASSEMBLED automatic switchboard contained within envelope of multiple-beam, multiple-deflection-plate cathode ray gun.

• **Small, simple device** that can ionize gases passing through it and eject them in a controlled, high velocity stream. This may be an application for the nuclear energy from radioactive materials.

• **Bi-stable semiconductor** which is highly resistive to voltages under one volt, but which changes to a very low resistance state when a high voltage is applied.

This second stable state should be held after the higher voltage is removed as long as at least one volt d.c. is continuously applied.

This device will be recognized as a close relative of the newly developed NPNP transistor. It should have a counterpart which would change states when bombarded by an electron beam instead of the application of high voltage.

• **Semiconductor** which can operate as a linear amplifier of 10w. output. Alpha cutoff should be at least 2,000 mc. Critical quality control requirement for this device is phase shift. The amplifier must be controlled in production to a repeatability of linearity and phase shift within 1%.

Future Equipment

With these new components available in the future inventory, equipment of the future will be relatively easy to design. The USAF communications systems of the future will be made up of the following kinds of equipment:

• **Terminal equipment.** These will consist of telephone transmitters and receivers, teletype decoders and page printers, facsimile scanners and printers, and data sources and stores.

• **Multiplexing equipment.**

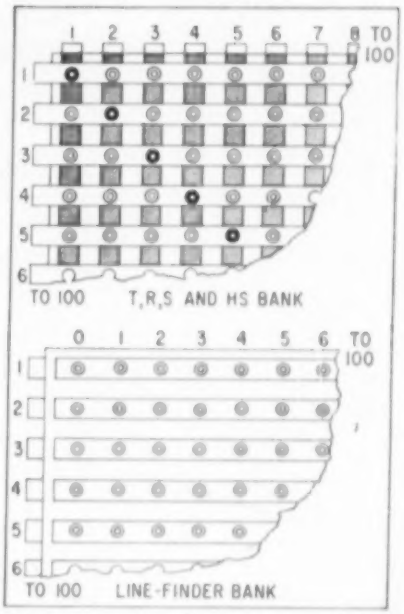
• **Switching equipment.**

• **Transmission media equipment.** This will include antennas and transmission lines, receivers, transmitters and frequency translation repeaters.

Switching equipment of the future will use same fundamental building blocks as switching equipment today.

The accompanying sketch shows the makeup of a basic 100 line switchboard using some of the new components described earlier.

The sketch shows two signal banks, T and R, two control banks, S and HS, and the line finder. Each of these banks will consist of an insulator board on which is printed 100 vertical conductors on one side and 100 horizonal conductors on the other side.



LAYOUT of control banks (top) and line finder banks (bottom) for automatic switchboard. Control bank conductors run vertically on one side of insulator board, horizontally on other side. Line finder bank conductors all run horizontally.

Between each crossing of the horizontal and vertical conductors a hollow cylinder is inserted which connects the two conductors. This hollow cylinder is the bi-stable semiconductor previously described.

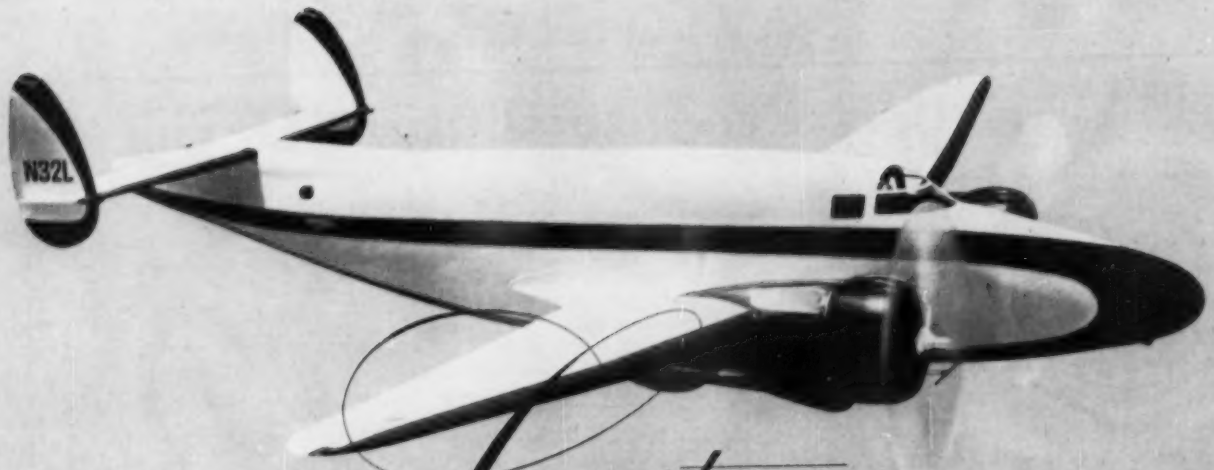
Line Finder

The line finder consists of 100 horizontal conductors on both sides of an insulator board, with hollow cylinder semiconductors connecting the two opposite conductors through the insulator. The line finder banks resemble the signal and control banks except for one additional cylinder on each line (see sketch).

The signal and control banks are then stacked with a line finder bank at the front and rear with the whole assembly mounted in front of a multiple-beam, multiple-deflection-plate cathode ray gun.

The operation of this future automatic switchboard would be as follows:

When the calling party lifts his telephone, a three-quarter volt bias is applied to his line on the line finder bank. Also, any available electron beam begins scanning vertically at the



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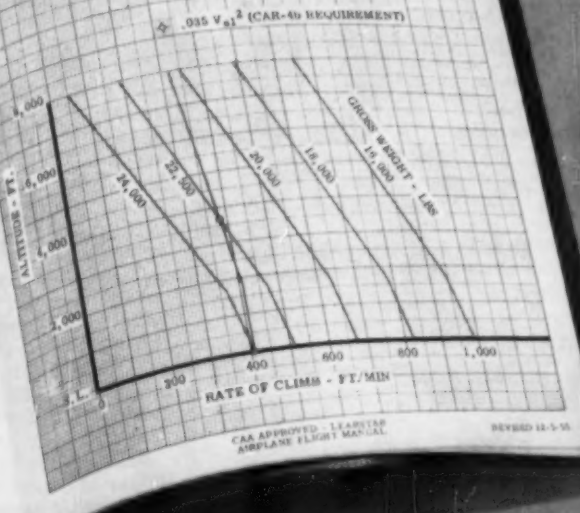

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Outboard view of short stack exhaust to 5 cylinders showing flush tail pipe.

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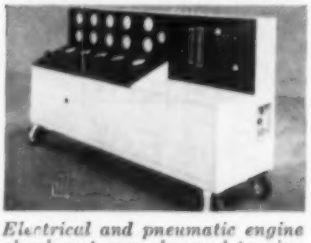
CONVAIR 340 TO PACAERO FOR NAPIER ELAND TURBO-PROP CERTIFICATION—To further demonstrate the efficiency and performance of the new Eland propellor turbine engine installed in the Convair 340 or 440, Napier has selected PacAero to perform all flight tests and modifications, and to obtain U.S. 4b airline transport licensing for both the modified airliners.

Facilities encompassing 280,000 sq. ft. at Santa Monica Calif., are headquarters operations for PacAero. Here, complete remanufacturing "from Lodestar to Learstar" is carried out.

JET AND ROCKET ENGINE TESTING EQUIPMENT BY PACAERO: In addition to its widely used test and ground support equipment, PacAero has recently perfected special mobile test equipment for use with jet and rocket engines. This forward step is especially significant in view of the increasing activity in this power field.



Electrical and pneumatic engine check-out console used to give final "dry run" of rocket engine's liquid fuel system.

GRUMMAN DISTRIBUTION NEW PACAERO DEVELOPMENT: In conjunction with its parent company, Pacific Airmotive Corporation, PacAero will be active in the sales, distribution and service of Grumman pressurized, twin-turbo prop Gulfstream business aircraft. This is another expansion of PacAero's complete sales and service operation.

Lodestar owners and operators, as well as those interested in details of acquiring the finest business aircraft, are invited to write PacAero for complete information and literature, including a copy of the new illustrated brochure "From Lodestar to Learstar, Step-by-Step."

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zero horizontal position until it reaches the calling line. The combination of the bias voltage and the electron bombardment of the hollow cylindrical semiconductor changes the state of the semiconductor so that it conducts, connecting the calling line to its corresponding lines on banks T, R, S and HS. At the same time the current flowing in the circuit produces the dial tone for the calling telephone.

When the number is dialed, a voltage corresponding to this number is applied to the horizontal deflection plates, deflecting the beam to the horizontal position corresponding to the called number. The electron beam passes through the hollow semiconductors at the junction of the called and calling numbers, changing the state of the semi-conductor and causing the called phone to ring.

When the called party lifts his phone, he applies a three-quarter volt bias across his line on the line finder banks and at the same time releases the electron beam. Because there is more than one volt across each semiconductor on the various banks, the circuit is maintained until one party hangs up.

According to Dr. Vogelman, the entire assembly could be incorporated in an evacuated envelope no larger than a two inch—or possibly a one-inch—cathode ray tube envelope, although he stressed that no attempt had been made to work out the detailed design.

Transmission Equipment

Dr. Vogelman said that he assumed a supersensitive, highly compact receiver, utilizing the low noise level of the super-conductive Maser plus transistors, would be available before the time under consideration. Accordingly, he discussed antennas, transmission lines and transmitters.

The extremely large antennas required at low and very low frequencies to achieve even moderate efficiencies have severly limited their use. The introduction of high Mach number aircraft has extended this problem even to high, very high and ultra high frequencies. Even flush antennas have left much to be desired.

The ferrite-like materials described as a new component requirement is ideally suited to solving the ground antenna problem at low and very low frequencies.

A conductor embedded in a medium will resonate at any given frequency when its length is one-quarter wavelength long above the ground plane in the medium. When the medium is the ferrite-like material considered earlier, the length required would be about one-hundredth of that required in free space.

The antenna of the future would then consist of a broadband radiator embed-

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North-Seeking Gyro

Portable instrument for aligning missile launchers, mobile radars or inertial guidance systems to true north without celestial reference has been developed by North American's Autonetics Division. Device, called ABLE (Autonetics Base Line Equipment), contains precision north-seeking gyro, weighs 70 lb. It can be aligned to north by inexperienced personnel in less than 30 min. at 30 deg. latitude, less than one hour at 60-70 deg. latitude, NAA says.

ded in this material. The thickness of the material would be selected to match the composite impedance of the radiator and the ferrite to free space. This type of antenna would be of practical size (about 100 ft.) and extremely efficient in comparison with the top-loaded antennas used today.

With this type of antenna it would be practical to build multi-element arrays which could be electronically steered. The ferrite-like material could provide the necessary device for doing this. The output of the transmitter would be fed into a number of transmission lines, one for each radiator. In each transmission line the ferrite material would be used as a phase shifter, with the phase shift controlled by an electromagnet, to form a beam in the desired direction.

The technique could be applied to other types of phased arrays and would be extremely broadband because of the constancy of phase shift for fixed length and magnetic field, independent of frequency.

Airborne Antennas

For airborne antennas, the gas-ionizing device can provide for the first time an antenna which not only has no drag but which actually provides thrust. An ionized gas is a conductor of electromagnetic energy. To obtain the equivalent of a trailing wire antenna for high

Mach number aircraft, either intake air or fuel exhaust gases would be ionized and ejected rearward in a stream.

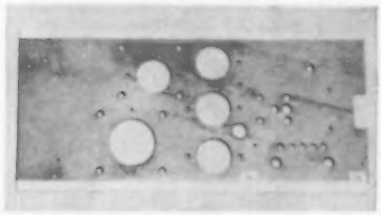
This stream would form an ionized conducting column which would efficiently couple the transmitter to free space. Adjusting the velocity of the ionized gas stream would control the length of the conducting radiator to provide maximum radiated power.

Vacuum tubes are the major problem in present day transmitters because of their low efficiency and poor reliability. If the power needed to heat the filaments and provide air or liquid cooling is included as part of the input, the radiated output power proves to be a very low percentage of the input power.

For this purpose, the 10 w. linear semiconductor amplifier provides an attractive solution. Even for 40 kw. total output, the 4,100 semiconductors required would occupy less space than present equipment. Using audio power transistors for comparison, the total bulk required using semiconductor amplifiers would be about 3 cu. ft.

The reliability of the transmitter would be increased many times. The individual increase in reliability of the semiconductor over the vacuum tube is well known, in this case, however, the major increase in reliability results from the large number of components in parallel. The failure of a component or amplifier does not reduce the output power by more than 0.02%.

If the ideas presented cause the reader to disagree, or if they stimulate his imagination, then, as Dr. Vogelman stated, his paper will have completely served its purpose. He said that communication in this rapidly changing air age is the major stumbling block in almost all operations. He predicted that once scientific minds are stimulated to think about future problems, improvement in performance will follow.



No Insulators Needed

New anodizing process coats aluminum avionic chassis with dielectric film which eliminates need for insulating individual components from the chassis, yet provides good thermal path for conducting heat from components to chassis. Dielectric film reportedly has resistance of several thousand megohms. Process was developed by Hughes Aircraft Co. and Anachrome Corp., affiliate of Anadite, Inc., South Gate, Calif.

HONEST JOHN artillery rocket depends on G-E electric heating blanket (inset) to bring missile to uniform operating temperature before launching.

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for Convair conversions

The Brazilian airline REAL Transportes Aereos do Brasil of Sao Paulo is to convert three of its fleet of piston-engined Convair airliners to Napier Eland turbo-props.

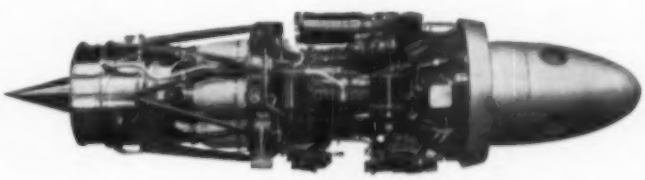
REAL states that it intends to convert its entire fleet of Convairs—another 17 aircraft—after assessing the results of the first conversions. With the substantial increase in power, range and speed, these converted Convairs will show a high financial return. Improved operating flexibility, lower maintenance costs, and long component life and reliability in all conditions are all attributes of the Eland made possible by its advanced and fundamentally simple design. Passenger appeal too will be high because of the smooth, quiet journeys which the propeller turbine brings to modern air travel. And the extra 2,000 h.p. available will enable the aircraft to carry its full payload when operating from high altitude airports and at the highest ambient temperatures.

This Napier conversion scheme can be introduced into certain other piston-engined airliners, besides the Convair, with no less impressive results in operating efficiency.

Napier Engines Inc., a subsidiary of D. Napier & Son Limited, with its headquarters in Washington DC., has been recently formed to support the Eland conversion program in North and South America.

NAPIER ENGINES INC., Suite 909, Dupont Circle Building, 1346, Connecticut Avenue, N.W. Washington 6, D.C. Tel: Dupont 7-2123. Cables: Napier-Washington

is beginning



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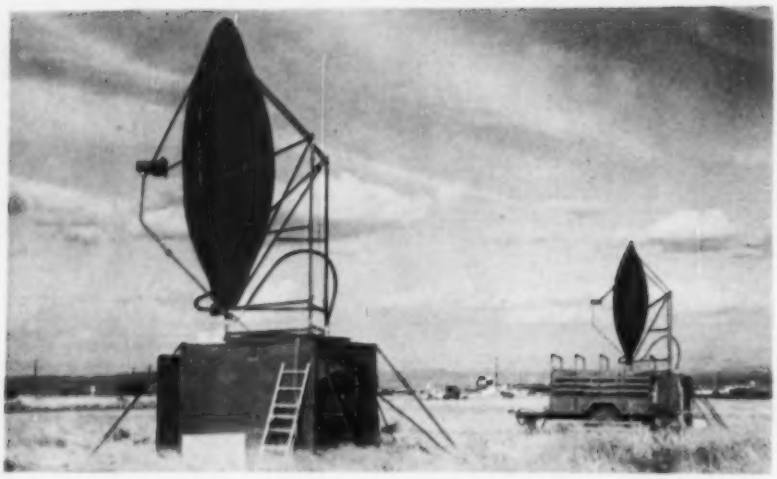

PORTABLE tropospheric scatter communications system uses dual air-inflated antennas.

Scatter Communications System Uses Portable Plastic Antennas

Ft. Huachuca, Ariz.—Compact, air-transportable tropospheric scatter communications system which employs lightweight 15 ft. diameter air-inflated plastic antenna reflectors is being evaluated here at Army's Electronic Proving Ground.

System, developed by Collins Radio, can be completely packed in two metal huts which can be carried in C-119 or C-124 transports and which serve as shelters for the avionic equipment when system is installed. System operates in the 1,000 mc. (UHF) band and provides multi-channel service over distances of 50 to 150 mi.

Antenna reflectors are constructed of plastic material clamped to a hoop and sealed to provide air-tight parabolic shaped surfaces when inflated. Inside surface of rear section is coated with aluminum to serve as reflector of radio energy emerging from feed horn mounted in front. Construction resembles the Paraballoon radar antenna developed by Westinghouse Electric (AW Oct. 22, 1956, p. 94).

Approximately 12 min. are required to inflate the lollypop-shaped antenna reflector initially by means of a motor-driven blower. Reflector air pressure is continuously maintained by on-off cycling of the blower.

Inflated antenna is designed to withstand winds of 70 mph., Collins says, and has withstood 50 mph. winds at the test site. Complete antenna, including tower, weighs about 400 lb., compared to 1,350 lb. for an equivalent antenna of conventional construction. Antenna is quickly erected, Collins says, and adjustments make it possible to shift reflector aiming point over a range of ±3 deg. in elevation and ±5 deg. in azimuth.

Feed horn is open-ended waveguide type, providing VSWR less than 1.3:1 over the 755-985 mc. range which eliminates need for an antenna tuner. Reflector has 6 ft. focal length and feed provides a 10 db. illumination taper with approximately 29 db. gain relative to an isotropic antenna, Collins reports.

Two hut enclosures each measure approximately 7 x 7 x 8½ ft. One houses exciter, receivers and bandpass filters and diplexer. The other contains a 1 kw. power amplifier, klystron and power supply. System employs two antennas at each terminal to provide space-diversity operation.

AIR-inflated tropospheric scatter communications antenna is quickly erected.

Louis S. Rothschild Among AMB Speakers

Philadelphia—Franklin Institute has announced major speakers at its upcoming symposium on "The Airways Modernization Board: Its Mission and Methods," to be held Dec. 16-18 at Sheraton Hotel in Philadelphia. Principal speakers and their subjects include:

- **Elwood R. Quesada,** AMB chairman: "The Airways Modernization Board: Its Role in U.S. Aviation—Present and Future."
- **James L. Anast,** AMB acting technical director: "The Airways Modernization Board Program."
- **Louis S. Rothschild,** Under Secretary of Commerce for Transportation.
- **Milton W. Arnold,** vice president of operations and engineering, Air Transport Assn.; Joseph T. Geuting, Jr., Aviation Facilities Planning Group, and E. Thomas Burnard, executive director, Airport Operators Council: "Airways Modernization—A Combined Effort."
- **R. S. Barnaby,** W. W. Felton and R. S. Grubmeyer, Franklin Institute: "A Systems Approach to the Air Traffic Control Problem."
- **Benjamin F. Green,** AMB technical staff "Some Technical Aspects of the AMB's Program."
- **Richard H. Jordan,** AMB director for operations analysis: "The Place of Op-

Missile Tracker

Telemetry antenna, with 60 ft. reflector, is one of five new additions to Air Force missile range extending 5,000 mi. from Cape Canaveral, Fla., into the South Atlantic. The 35-ton telemetry antennas, designed and produced by D. S. Kenney & Co., are being installed at Canaveral and Malabar, Fla., the Ascension Islands, Antigua, British West Indies, and Fernando de Noronha, Brazil. Antennas also will be used to track U.S. earth satellites.

MICRO-BEARING ABSTRACTS

by **A. N. DANIELS,** *President*
New Hampshire Ball Bearings, Inc.

MEASUREMENT OF RADIAL RUNOUT

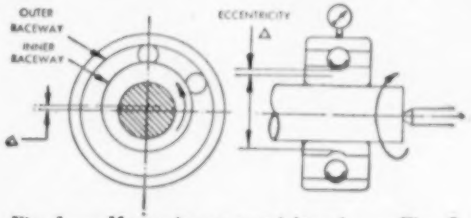

Fig. 1 — ***Measuring eccentricity of bore with respect to inner raceway.***

Fig. 2 — ***Inner raceway is out-of-round, although concentric with bore.***

Occasionally questions are raised about the methods of measuring "radial runout" and "out-of-round". In order to define "radial runout" properly, a discussion of "eccentricity" and "out-of-round" is necessary.

The amount of out-of-round, or lack of roundness of a given part (inner or outer ring or ball) is the difference between the maximum and the minimum diameter of the part in question.

Eccentricity refers to the distance between the centers of two circles. Concentricity refers to the exact coincidence of the centers of two or more circles. In high grade instrument bearings there is a very small tolerance on the permissible eccentricity between the bore and the inner ring raceway, and likewise between the outside diameter and the outer ring raceway.

Inner raceway out-of-round is measured by forcing the ring between the rounded edges of two discs, one of which is fixed and the other of which is mounted on the indicating mechanism. The difference between the maximum and minimum readings reveals the amount of out-of-round. Out-of-round of the outer ring raceway is measured by placing the ring over two rounded points which engage the raceway. One point is fixed and the other actuates an indicating mechanism. As the ring is rotated, the difference between the maximum and minimum readings indicates the degree of out-of-round.

The true amount of eccentricity between the bore and the inner ring raceway can be measured, providing these circles are not out-of-round, by mounting the assembled bearing on a slightly tapered arbor, applying a calibrated indicator on the center of the stationary outer ring, and then slowly rotating the arbor. The eccentricity is the difference between the minimum and maximum gage reading as the arbor is rotated through one revolution. Similarly, the eccentricity of the outer ring is measured by the difference in the dial readings with the arbor and inner ring held stationary while the outer ring is rotated one revolution. *Fig. 1* shows the set-up with an inner raceway which is eccentric with respect to the bore.

In the case above it has been stipulated that the bore and inner raceway must not be out-of-round, for only under these conditions is the true eccentricity measured.

If the raceway is out-of-round, while being either eccentric or concentric with respect to the bore, the out-of-round will be transmitted to the indicator, thereby influencing the reading. A condition in which the inner raceway is out-of-round although concentric is shown in *Fig. 2.*

In view of the fact that the majority of bearing rings will unavoidably be somewhat out-of-round and eccentric, however slightly, it is obvious that the measurement described above indicates neither true eccentricity nor true out-of-round but a summation of the two quantities. Hence, the measurement is more correctly termed radial runout.

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erations Analysis in the Work of the AMB."

• **James N. Davis,** AMB consultant: "How AMB Will Operate."

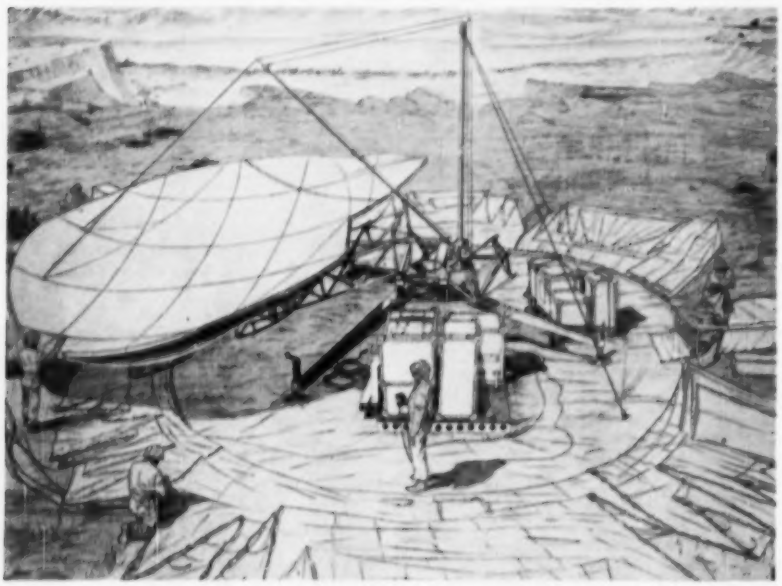
Registration fee of $50 will be charged to cover cost of luncheons, banquets and copy of symposium proceedings.

Registrations should be sent to Capt. R. S. Barnaby, Chief, Aeronautics Section, Franklin Institute Laboratories for Research & Development, 20th & Parkway, Philadelphia 3, Pa.

Expansions, Changes In Avionics Industry

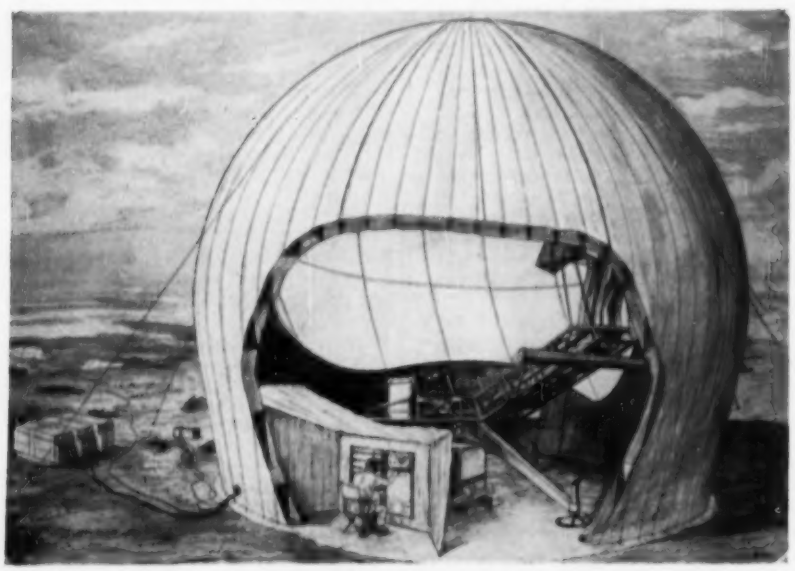
Precision analog computer center in New York City will be opened in February by Mid-Century Instrumatic Corp. of New York. The $250,000 Manhattan Computer Center will operate 24 hours a day, seven days a week.

The rates for charter subscribers have been set at $28.50 per hour for



Portable Early Warning Radar

Tactical early warning (TEW) radar system, being developed by Sperry Gyroscope Co. for Marine Corps, is lightweight, highly portable and provides three-dimensional data (bearing, height and range) at extremely long ranges. New AN/MPS-21 is about one-quarter the size and weight of conventional radar system, according to Sperry, employs dual beams in V-shape configuration to determine target height. Complete installation, including air-inflated dual-wall radome, reportedly can be set up in two hours.



Test Engineering at Marquardt

by
Roy E. Marquardt
President

Unique among air-breathing engines, the ramjet cannot run independently on the ground. Because ramjets depend on their velocity through surrounding air masses for compression of combustion air, intricate test facilities must be provided.

Marquardt Jet Laboratory simulates these high-speed, high-altitude flight conditions during ground testing. A USAF facility, combined with special USN test facilities, MJL is one of the most extensive in existence today. Valued at $18 million and occupying 8 acres of land, this dynamically functional engineering tool minimizes the number of costly trial and error flights of new engines.

Complex test cells, with associated instrumentation and computers, permit sea-level and altitude testing of full size and test-scale models. In our two sea-level test cells, high pressure air is directed over the test engine through subsonic, sonic, and supersonic nozzles, and exhausted to the atmosphere. Turbojets are ingeniously utilized in two full scale engine altitude test chambers to simulate heated and rarefied air conditions encountered by high-flying supersonic ramjets.

Special configurations in both sea-level and altitude cells permit angular motion of the free jet nozzles. This allows evaluation of the effects of varying angles of attack likely to be encountered by operational engines.

A new production acceptance test facility now being built in conjunction with our Ogden production plant will greatly supplement the up-to-the-minute equipment furnished the Marquardt Test Team.

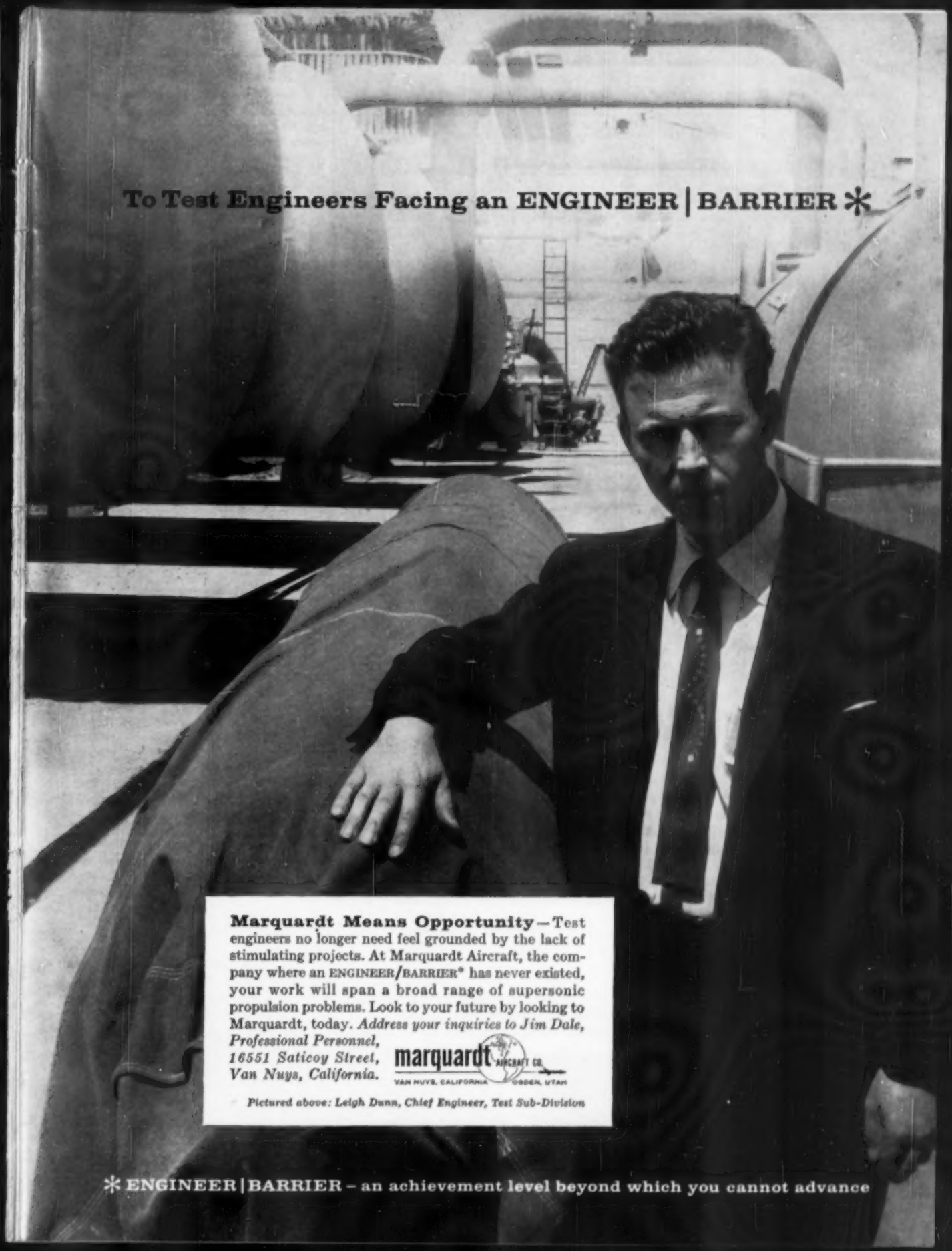
Within this Division, engineering openings exist for:

MECHANICAL ENGINEERS AEROTHERMO ENGINEERS
ELECTRICAL ENGINEERS CONSTRUCTION ENGINEERS

For information about these positions and the professional engineering environment at Marquardt, we invite you to write Jim Dale, Professional Personnel, today.

Roy E Marquardt

marquardt AIRCRAFT CO.
VAN NUYS, CALIFORNIA OGDEN, UTAH
FIRST IN RAMJETS


To Test Engineers Facing an ENGINEER | BARRIER *
Marquardt Means Opportunity—Test engineers no longer need feel grounded by the lack of stimulating projects. At Marquardt Aircraft, the company where an ENGINEER/BARRIER* has never existed, your work will span a broad range of supersonic propulsion problems. Look to your future by looking to Marquardt, today. Address your inquiries to Jim Dale, Professional Personnel, 16551 Saticoy Street, Van Nuys, California.
marquardt AIRCRAFT CO.
VAN NUYS, CALIFORNIA OGDEN, UTAH
Pictured above: Leigh Dunn, Chief Engineer, Test Sub-Division
* ENGINEER | BARRIER – an achievement level beyond which you cannot advance

use of 48 amplifiers, company says. Center will have total of 136 amplifiers available.

Other recently announced expansions and changes in the avionics industry include:

• **The Barden Corp.**, Danbury, Conn., manufacturer of precision ball bearings, has opened new sales and engineering offices in Los Angeles. The 15,000 sq. ft. facility, headed by Robert Blase, is located at 3850 Wilshire Blvd. Barden also is constructing $2 million, 125,000 sq. ft. manufacturing facility in Danbury, slated for June completion.

• **Sprague Electric**, North Adams, Mass., will build 21,000 sq. ft. manufacturing facility at Visalia, Calif., to house operations now located at headquarters of Sprague's Pacific Division in Venice, Calif. Move will place operations about midway between Los Angeles and San Francisco when made in late spring of 1958.

• **Consolidated Controls Corp.**, subsidiary of Consolidated Diesel Electric Corp., will acquire business and certain assets of Manning, Maxwell & Moore's Aircraft Products Division, which develops and produces aircraft/missile controls, effective Dec. 31, 1957. Joseph F. Engelberger, general manager of the Aircraft Products Division, becomes president of Consolidated Controls Corp., and chief engineer H. W. Kretsch becomes vice president and chief engineer.

Radiation Effects

Battelle Memorial Institute has set up a Radiation Effects Information Center, under Air Force sponsorship, to gather and disseminate data concerning effects of nuclear radiation on materials and systems used in aircraft. Information center will compile, evaluate and summarize all available data, providing it to contractors and agencies designated by the Air Force in the form of reports, memoranda and monthly listings of data reviewed.

New information center, headed by Battelle's C. B. Voldrich, was established to support Air Force's nuclear-powered aircraft program but will also provide service to Army, Navy, Atomic Energy Commission and other government agencies. Center also will assist Air Force in defining areas in which radiation effects research should be initiated or expanded. Battelle Memorial Institute is located at 505 King Ave., Columbus 1, Ohio.

• **Cohu Electronics Inc.**, San Diego, has formed new Research Division with headquarters in San Diego and laboratories in Van Nuys at 14743 Lull St. New division is headed by Dr. Martin L. Klein.

• **CBS Laboratories** has broken ground for new $1 million 33,000 sq. ft. facility in Stamford, Conn., slated for occupancy next summer. Approximately 150 scientific and administrative personnel will be employed at new facility.

• **Cannon Electric Co.** has opened new 106,000 sq. ft. West Coast manufacturing facility in Santa Ana, Calif. The $1¼ million plant is expected to employ 1,500 persons within three years.

• **P. R. Mallory & Co.**, Indianapolis, has acquired plant, facilities and majority interest in **Milli-Switch Corp.**, Santa Monica, Calif. New acquisition, which produces snap-action switches and actuating devices, will operate under own name as a Mallory subsidiary.

• **Applied Science Corp. of Princeton (ASCOP)** has renamed its former Switch Division which will be known as the Electro-Mechanical Division, reflecting scope of its activities.

• **Jackson Electronic & Manufacturing Co.**, has moved to new quarters at 695 Johnston St., Akron, Ohio.

NOTABLE ACHIEVEMENTS IN WIND TUNNEL TESTING—NO. 2

CWT engineers are a dedicated group, spending many extra-curricular hours in the pursuit of basic scientific information. The result of a recent test is shown below.

BEFORE TEST AFTER TEST

What's In The Wind At The CWT...

Since 1942, the CWT's primary concern has been the developmental testing of high speed aircraft and missiles. From the Hermes to the Nike, from the Sabre Jet to the Star Fighter, the CWT has helped develop some of the most important names in aviation.

Today, there is more in the wind than ever at the CWT. A multi-million dollar modernization program, recently completed, has nearly doubled the Wind Tunnel's performance range. The CWT's ability to serve the industry is now greater than ever.

In addition to its owner companies, the CWT also serves other leading aircraft firms and government agencies.

If you would like more information regarding the Wind Tunnel, its services, or employment opportunities, you are invited to write us.

CWT SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL

950 S. Raymond Ave., Pasadena, California

Operated by the California Institute of Technology. Owned by Convair, Douglas, Lockheed, McDonnell and North American.

Instant Response Claimed for Climb Unit

By Russell Hawkes

Los Angeles—Inertial Vertical Velocity Indicator (IVVI) developed by Summers Gyroscope Co. here promises to answer pilots' need for an "instantaneous" rate of climb instrument.

Conventional instrument "based on a leaky altimeter" was never wholly satisfactory because it could lag by 10 sec. or more.

Many pilots learned to compute the rate quickly with an altimeter and a clock. The conventional instrument is becoming even less useful with the advent of high performance planes with such high rates of climb and descent that the instrument may not catch up until the airplane has nearly arrived at its new altitude. At 80,000 ft., the standard instrument may lag by well over a minute.

High response barometric vertical speed indicators are in the mill, but Summers engineers feel they will still suffer from the inadequacies of pilot-static systems or, if dynamically corrected, will be subject to unsatisfactory system transients.

Response rate of Inertial Vertical Velocity Indicator proved to be too fast in early tests and indicator lag was artificially increased from 25 milliseconds to 65 milliseconds to filter out aircraft vibrations and small scale turbulence.

Unsolicited Proposal

Inertial Vertical Velocity Indicator grew out of an unsolicited proposal of Navy BuAer which resulted in a development contract for $94,484.33. Summers has also put in a private investment exceeding $100,000. One prototype instrument has been delivered to the Navy and a second is about to be delivered. Wright Air Development Center has expressed interest in doing an independent USAF evaluation. When results are in, the services may get together and discuss preparing military specification for this type instrument. Prototypes have logged about 150 hr. flying time to date. They weigh 43 lb. apiece, while production versions are expected to weigh in the neighborhood of 20 lb. Even this weight might seem excessive but for the fact that the unit has many components in common with other instruments which would naturally be shared to avoid duplication of weight, volume and function. Estimates of net weight, excluding growth factor, added to the airplane by installation of IVVI run from three to 10 lb.

LARGEST IVVI box contains vertical gyro, accelerometer pickup, aneroid altimeter. Small black box is accelerometer amplifier. Gray boxes amplify signals; fourth unit is indicator.

Original BuAer specification, written at the time the development contact was let, required that the instrument work between altitudes of 80,000 ft. and 1,000 ft. below sea level and tolerate vertical speeds of 60,000 ft./min. without damage. This last requirement is not interpreted to mean that the instrument must indicate such high vertical velocities. Largest vertical speed indication on the face of the prototype instrument is 6,000 ft./min.

Inertial Vertical Velocity Indicator, as its name indicates, is an inertial instrument which integrates acceleration once to produce the desired rate measurement and integrates rate to produce altitude for comparison with an aneroid altimeter.

The differential of inertial and barometric height is put into a feed-back loop to cancel the inevitable integration error which would otherwise continue to grow with time.

Inertial Pickup

The heart of the instrument is an inertial pickup held in a vertical orientation by a three-axis redundant gimbaled gyro. Pickup is mounted on the vertical inner gimbal ring. The gyro will remain erect during acrobatics and need not be caged. Outer gimbal is servo driven to maintain the angle between the inner and middle gimbals with 60 deg. of the right angular relationship regardless of maneuver unless the airplane rotates at a velocity greater than one revolution per second. Evolutions of this violence are not foreseen.

Alternating current in the system is 400 cycles. Unfortunately, natural frequency of first inertial pickup used was also 400 cycles. This has since been reduced to 250 cycles to eliminate resonance.

Crux of the design problem in the Inertial Vertical Velocity Indicator was need for fast response, error-free inte-

Credit Moratorium

Existence of Inertial Vertical Velocity Indicator in an advanced stage of development may have an important bearing on the outcome of Summers' current financial troubles. The company needs cash to get contracts and contracts to get cash. A 90-day moratorium granted by creditors late last month breaks the circle by providing cash for that period.

A number of large corporations, one of which is reported to be Atlas Corp., are seeking to merge with Summers to take over the company's tax loss and a number of promising instruments including Inertial Vertical Velocity Indicator.

This instrument and a Navy bomb director system are the hottest development items in the shop but in the normal course of events it would take another year for a production contract to jell if one is forthcoming.

Another **DALMO VICTOR** *achievement*

DV magnetic system finds submarines below the surface

The use of Magnetics has greatly increased the accuracy of airborne submarine detection. Magnetic devices supplied by Dalmo Victor to the Navy now equip the Lockheed P2V-7 . . . help it locate submarines even when submerged. The versatile bomber's protruding, wasp-like tail houses the complete Magnetic System that pinpoints submarines for a quick kill in all weather.

Currently Dalmo Victor is developing new and more advanced Magnetic Systems for submarine detection. These systems utilize a combination of DV's skills in electro-mechanisms, hydraulics, servo-mechanisms, electronics and magnetics.

Remarkable improvements in magnetic detection systems have resulted from techniques introduced by Dalmo Victor. These same techniques are adaptable to solving problems in communications, guidance and related fields. Find out how Dalmo Victor's engineering and production capabilities can work for you.

DV

DALMO VICTOR COMPANY

Division of Textron Inc.

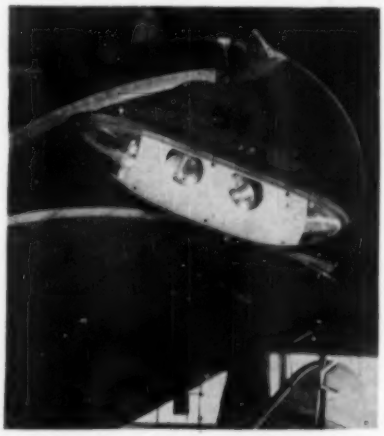
BELMONT, CALIFORNIA

Eastern Office: Washington, D.C.

gration of acceleration. Nullification of integration error by feedback of pressure altitude offered a sound theoretical approach but progress was stymied for a while by lack of a fast response integrator and a sensitive aneroid pick-off.

Integrating Motor Design

Summers engineers have designed and built dual-wound d.c. integrating motors with inertia of only 5×10^{-4} ounce-inch-second. Their best motor converts electrical to mechanical energy with an efficiency of 99.9% at the light loads in this application. Torque sensitivity is .007 ounce-inch/milliamp. The motor is fabricated by winding the armature of 40 to 44 gage wire upon a core made by encasing the field magnet in aluminum and machining to size. After the armature has been wound onto the core it is impregnated with a clear thermal setting plastic and the aluminum core case is chemically etched from between the magnet and the armature. The magnet is then cantilevered from the motor chassis and a base plate and shaft are



Relative Danger Light

Latest installation of Atkins relative danger light, designed to prevent mid-air collisions, (AW Oct. 2, 1955, p. 78) was made recently on North Central Airlines DC-3. One unit was installed under each wing tip. Each unit contains four white, stroboscopic capacitor-discharge-type lamps which emit a brilliant, very short duration flash at different intervals. Forward lamp flashes 160 times a minute, two on the side 80 times a minute and the rear light 40 times a minute. This allows the pilot of another plane to determine whether the relative danger light equipped aircraft is approaching him, is on an approximately parallel course, or is flying away from him. North Central says the lights are readily visible at 30-40 mi. Units were installed as part of a fleet modernization program to evaluate them under actual airline operating conditions. Lights were developed by Capt. H. William Atkins, a Northwest Orient Airlines pilot.

attached to one end of the armature. Thickness of impregnated armature varies from .077 in. to .015 in., depending on wire gage used. There is virtually no loss due to end leakage as the field magnet is almost completely enclosed by the armature. Zero source impedance time lag is 5 milliseconds. Second winding acts as a tach generator producing a voltage used to control motor current curve which is a direct measure of one winding error.

Amplifiers for the basic signal located ahead of each integrator also serve as adders to put in corrective feedback from the pressure altimeter.

Smooth Operation Required

Pressure altimeter accuracy is not critical in system operation. An error of a thousand feet could probably be accepted without causing trouble. Only real requirement for the aneroid instrument is smooth operation with minimum hysteresis, backlash, etc. If aneroid bellows were shared with some other instrument requiring more accuracy, it would be obtained without much difficulty.

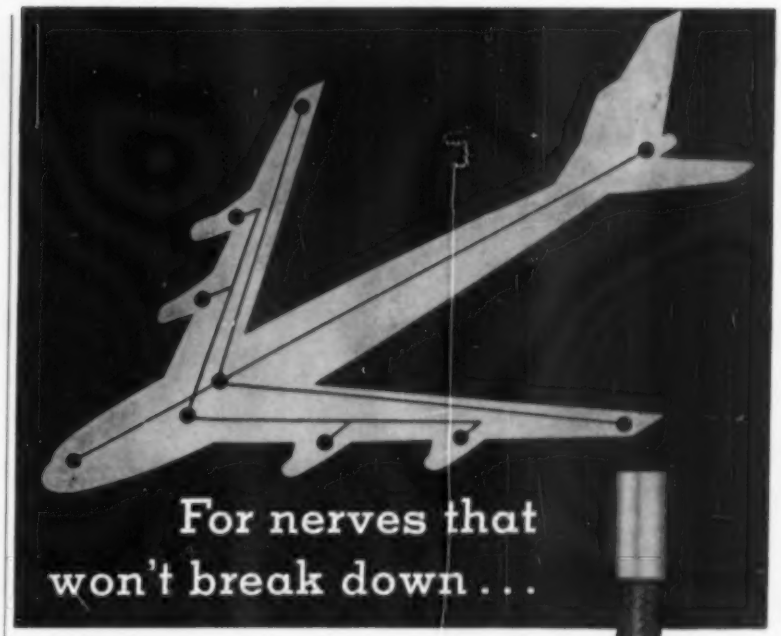
Chief problem associated with the pressure altimeter is picking off and interpreting aneroid position. Output end of bellows moves only about one inch for the full 81,000-ft. operating range of the instrument. Potentiometer pick-offs failed to work out because output required amplification factor as high as 10,000 which calls for high carrier frequencies that must be rectified for use in servo loop. A high response photocell device putting out 10 VDC per mil of aneroid travel, eventually was adopted. This eliminated weight of oscillators and rectifiers and noise problem associated with high amplification since none is necessary. In fact, output is slightly attenuated.

Photocell and light source are moved through an arc of 83 deg. for 80,000 ft. variation of altitude by the output from the second integrator. A mask between the two is rotated at the same rate by the aneroid output. Light reaching the sensitive element is controlled by the relative position of light source-photocell and mask.

Photocell Movement

Developing error appears as relative movement and displacement generates a proportional d.c. error signal which reaches its maximum strength when error reaches 400 ft.

Accuracy of computations is within a few hundredths of a percent at vertical speeds up to 6,000 ft./min., the maximum vertical speed which the indicator will register. The working parts of the instrument will follow vertical speeds to as high as 60,000 ft./min. in obedience to the BuAer specification but with reduced accuracy.



. . . specify

REVERE TEFLON* CABLE

Electronic cables, the "nerves" of monitoring and testing systems in missiles, rockets and aircraft, are constantly being stressed by the searing heat around jet engines . . . the sub-zero cold of the stratosphere . . . immersion in fuels, chemicals or solvents. Revere Teflon Cable meets these high service requirements . . . and those of computer and radar applications, too.

Revere Teflon Cables are available with 1, 2, 3 or 4 teflon-insulated, silver plated, stranded copper conductors, rated for continuous operation from —90°C. to +210°C. Cables are shielded with silver plated copper to give 90% coverage. Jackets to suit application — silicone treated glass braid, teflon, Kel-F**, vinyl, nylon, etc.

Conductor size: 24 to 18 gage in .003" (300 volt), .010" (600 volt) and .015" (1000 volt) wall thicknesses. Ten and fifteen mil wall conductors meet applicable requirements of MIL-W-16878, Type E and EE.

*E. I. du Pont trademark
**M.W. Kellogg trademark
† Wire passes 500 hr., 250°C heat-aging test . . . also cold bend test

TYPICAL SPECIFICATIONS — Single Conductor Teflon Insulation

Spark Test Voltage	3000 volts
Insulation Resistance	Greater than 10^4 megohm/1000 ft.
Continuous Operating Range	—90°C. to +210°C. (†)
Dielectric Constant @ 1 MC/Sec	2.5 maximum
Power Factor @ 1 MC/Sec	Less than 0.0003
Flammability	Does not support combustion
Shrinkage	Less than ⅛" in 18" @ 250°C for 96 hrs.
Abrasion (per MIL-T-5438)	Passes 38" of 400 grit, aluminum oxide, ½ lb. weight
Moisture Absorption	0.0%
Specific Gravity	2.2 average
Chemical and Solvent Resistance	Excellent

Write today for Engineering Bulletin 1905 describing Revere TEFLON CABLE.

REVERE CORPORATION OF AMERICA
Wallingford, Connecticut
A SUBSIDIARY OF NEPTUNE METER COMPANY

neptune

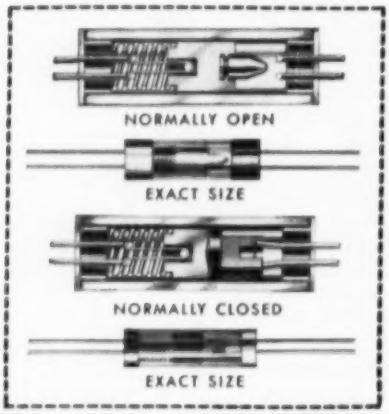
MINIATURE THERMAL RELAYS

with

99.99% Plus Reliability

SERVICE-FITTED
SERVICE-TESTED
SERVICE-APPROVED

Our complete environmental testing laboratory samples and certifies daily production.



New NORMALLY CLOSED RELAYS NOW AVAILABLE. They both meet or exceed requirements for guided missiles and complex electronic gear.

They are hermetically sealed by bonding metal headers to high thermal, shock resistant glass housings.

They open or close a circuit **positively** in 0.1 second or other delay times.

They can also be safely used as a "squib" or timing mechanism.

Typical Characteristics

Temperature:	—100°F. to +450°F.
Vibration:	20-3000 CPS at 40 G's
Shock:	250 G's

Brochure containing complete characteristics and specifications available upon request.

NETWORKS ELECTRONIC CORPORATION

14806 OXNARD ST., VAN NUYS, CALIF.

Original designs for highest reliability in glass housed miniature Relays and Resistors for all purposes

ARMY'S new mobile liquid oxygen plant, produced by Air Products Inc., Allentown, Pa., can produce liquid oxygen within few hours after arrival at launching station.

Liquid Oxygen Plant Is Mobile

Mobile liquid oxygen factory mounted on four semi-trailers recently was delivered to U. S. Army Corps of Engineers by Air Products, Inc.

Factory, which cost $1 million, will act as a battlefront liquid oxygen plant to supply the large quantities of oxidant needed by Army missiles such as Redstone and Jupiter C.

Plant Output

The plant is designed to produce 20 tons—about 80 barrels— of 99.5% pure liquid oxygen per 24 hr. day from common air when operated at normal atmospheric pressure and at 50% humidity.

Total weight of the four trailers is approximately 200,000 lb. Each is 8 ft. wide, 11 ft. high and 30 ft. long.

Factory will operate in ambient temperatures ranging from 125F to 25F. It uses 920 lb. of diesel fuel per hour and yields about two pounds of liquid oxygen per pound of fuel consumed.

Two of the trailers are identical. Each carries a 1,200 hp. opposed-piston diesel engine (same as the light weight Navy submarine engines) which drive two-stage rotary compressors to compress air to 100 psi. Diesels also drive generators to supply the plant's electrical power. All of this equipment is supplied by Fairbanks-Morse.

Heat Exchangers

Trailers also incorporate extended-surface heat exchangers for cooling both the diesel and the compressor and to provide preliminary cooling for the compressed air as it leaves the unit.

Compressed air is fed into a heat exchanger mounted on a third trailer. Here it is further cooled and water vapor, carbon dioxide and other impurities are frozen out. When it emerges from this unit, air is very near the liquid state.

Air then passes to the fourth trailer where it is transformed into liquid oxygen.

This trailer also houses a control panel whose instruments show the condition of all major machinery in the various trailers.

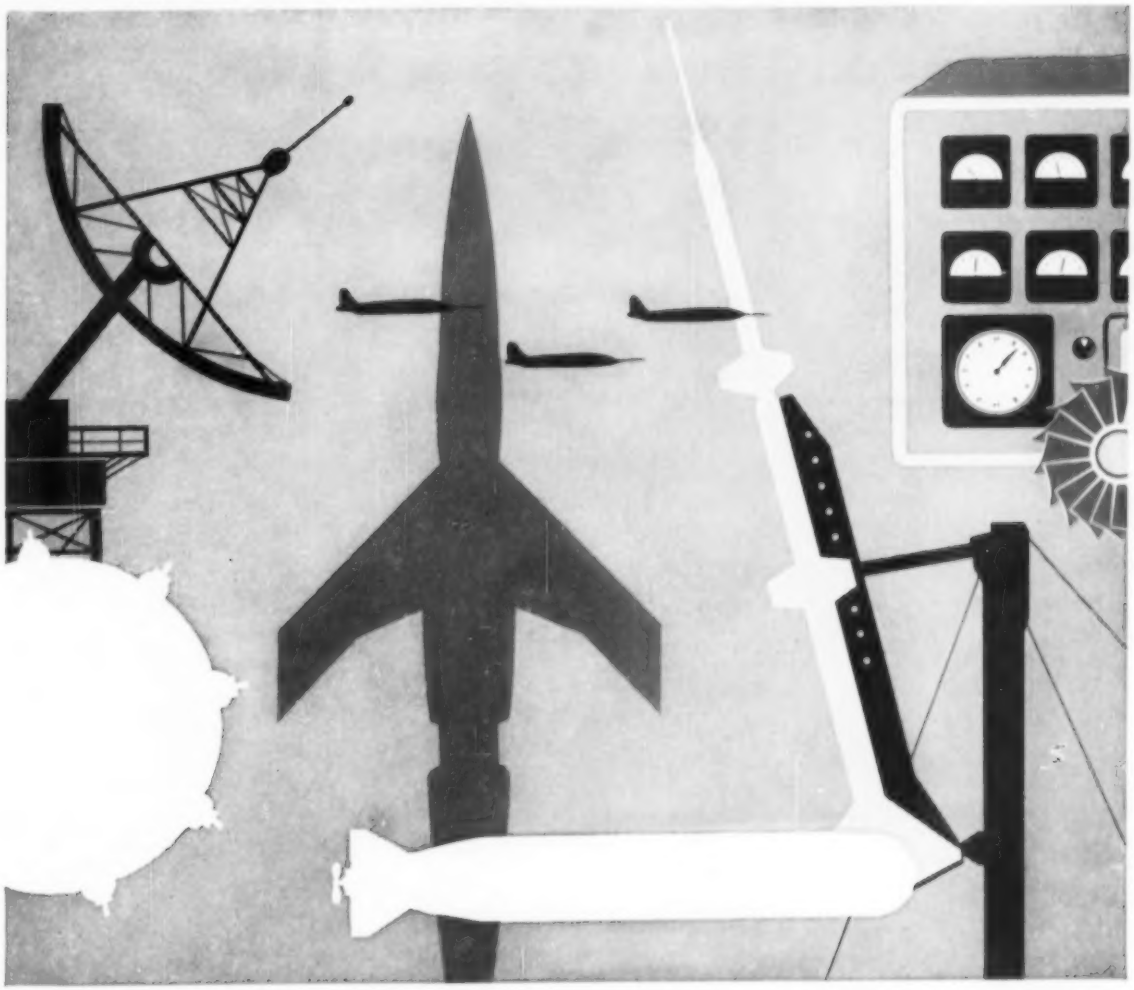
Special, low-temperature trailers haul the liquid oxygen as it comes from the plant to the missiles or to storage areas. Each such trailer is capable of holding 9 tons of liquid oxygen and of moving it hundreds of miles.

Heated Tent Speeds Plastic Mold Curing

Dallas—Heat-curing tent developed by Chance Vought Aircraft, Inc. for curing plastic molds installed around F8U-1 wiring harness electrical connections has cut curing time from 36 hr. to 5 hr.

Tent is made of aluminized canvas and is 41 ft. long, 7 ft. wide and 8 ft. high. A framework of 2-in. pipes keeps the structure in shape and supports six electric heaters of two or four kilowatt power to blow air heated to 118F into the tent. Moisturizing unit facilitates drying.

Electrical wiring harnesses for F8U-1 Crusaders are assembled on 40-ft. wiring boards. Plastic potting compound, Thiokol, is poured on the connections. Then overhead hoists place the tent over the assemblies for curing. Tent was developed by manufacturing research engineers E. V. Block and F. M. Partridge. Before their device was developed, boards had to stand 24 to 36 hr. while the potting compound cured at room temperature.



Throughout the Pattern of Modern Defense...

AMF has experience you can use

• Most defense problems fit into AMF's "big picture"... a picture drawn from AMF's tremendous backlog of experience in defense work. Wherever you are, there's probably an AMF defense component or integrated system... a product of AMF experience... operating near you. • Guided missiles ride on AMF equipment to AMF launching sites ...to be loaded, fueled and fired by AMF-built equipment. Under the sea, AMF-built weapons wait for unfriendly submarines on the prowl. Along our borders, AMF radarscopes search the sky for "stranger" aircraft. • There is little room for failure where the job is the nation's defense. And the nation looks to companies like AMF to design, test and produce a variety of defense products. With a wide range of experience in the most sensitive fields of defense work, AMF may well be the answer to your problems... in defense or industry.

- Armament
- Ballistics
- Radar Antennas
- Guided Missile Support Equipment
- Auxiliary Power Supplies
- Control Systems

AMF DEFENSE PRODUCTS

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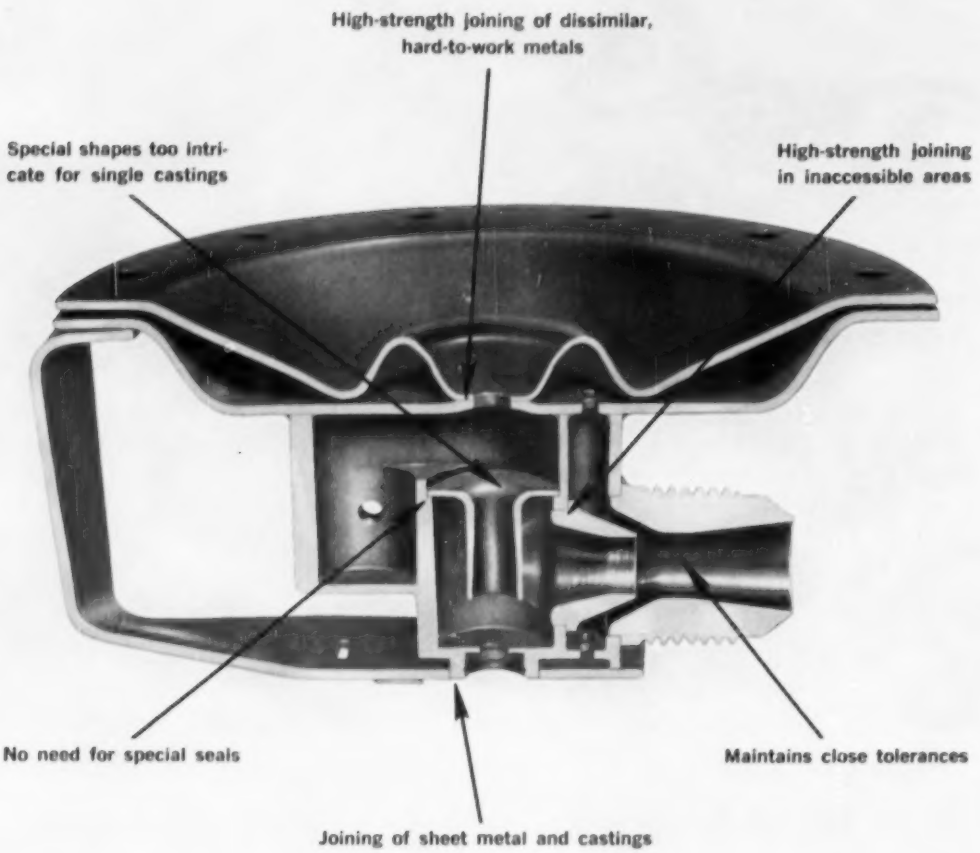
Solar advanced brazing technology offers these advantages


High-strength joining of dissimilar, hard-to-work metals
Special shapes too intricate for single castings
High-strength joining in inaccessible areas
No need for special seals
Maintains close tolerances
Joining of sheet metal and castings

THIS INTRICATE CONTROL UNIT demands utmost precision—in design, manufacturing and assembly. That's why Solar engineers planned the entire unit for high-temperature brazing. This advanced joining method produces lighter, stronger, more compact components—faster, and at less cost.

Lightweight aircraft and missile components, for example, can be made to withstand higher temperatures than those at which they were brazed. And they can be made from dissimilar metals and high alloys that are *right* for high-temperature applications.

Effectiveness of this advanced assembly process has been proven by years of experience. If you would like to know how Solar can apply this design and brazing experience to your particular manufacturing problem, write to Dept. D-119, Solar Aircraft Company, San Diego 12, California.

SOLAR
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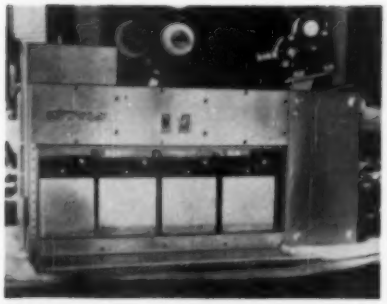
DESIGNERS, DEVELOPERS AND MANUFACTURERS of gas turbines, expansion joints and aircraft engine, airframe and missile components.



PORTABLE automatic film processor develops, dries 100 ft. of movie film in 20 min.

Fast Process Unit Developed for Film

New York—Automatic, self-feeding, portable film processer which can develop, dry and have ready for projection 100 ft. of black-and-white 16 mm. movie film in 20 min. has been put on the market by Fairchild Camera and Instrument Corp.

Called "Mini-Rapid 16," the machine requires only a 110 v. a.c. outlet to process film.

It can perform its entire function in broad daylight, from loading to turning out finished film.

At a recent New York demonstration, the machine proved it could develop commercial quality film in a matter of minutes. More permanent records can be obtained by running the film through the machine a second time for a more thorough wash. An accessory kit is available for attaching the machine to a water pipe, thereby permitting a constant-flow washing operation.

Machine is the first of a family of developing devices to be produced as shelf items by Fairchild. Next units will be designed to handle, respectively, 35 mm. film, 70 mm. film and photographic paper.

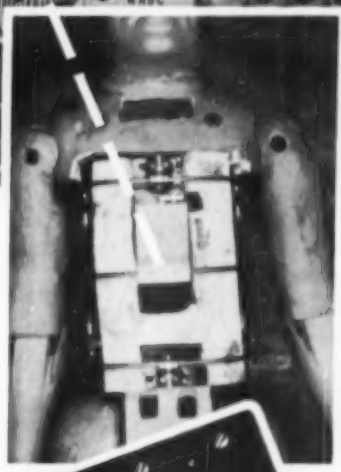
Among types of photographic evaluation which might be expected to benefit from the machine are: records of oscilloscopes, gun camera films, missile firing records and high speed machine operation shots.

Mini-Rapid 16 accepts a roll of 16 mm. film in a compartment at the left of the machine. Film is inserted emulsion side down in an entry port and compartment is closed.

Film is automatically threaded through the processor to take-up spool on top of the machine, a trip of approximately 7 ft.

Film is passed through four 18 oz. tanks containing, respectively, high-speed developer, rapid fixer, hypo-eliminating agent and static rinse. Film is then dried by a high-velocity air jet blowing on the emulsion side. Film emerges from drying compart-

DATA from a DUMMY



with an FM TELEMETRY Transmitter

Sensitized for human reactions, this dummy helps collect human factor data for development of ejection seats for supersonic jet aircraft. The full-scale rocket sled tests are one phase of the industry-wide program to develop a safe standardized pilot escape system for the Air Force.

The Model 3021 Transmitter used in these tests is a rugged subminiaturized unit designed for high shock impact and extreme environments.

Frequency	**- 215-235 mc**
Power Output	**- 2 watts**
Weight	**- 1.7 pounds**

Write for complete data and prices to P. O. Box 37, Melbourne, Florida

Personnel Inquiries Invited.

RADIATION INC.

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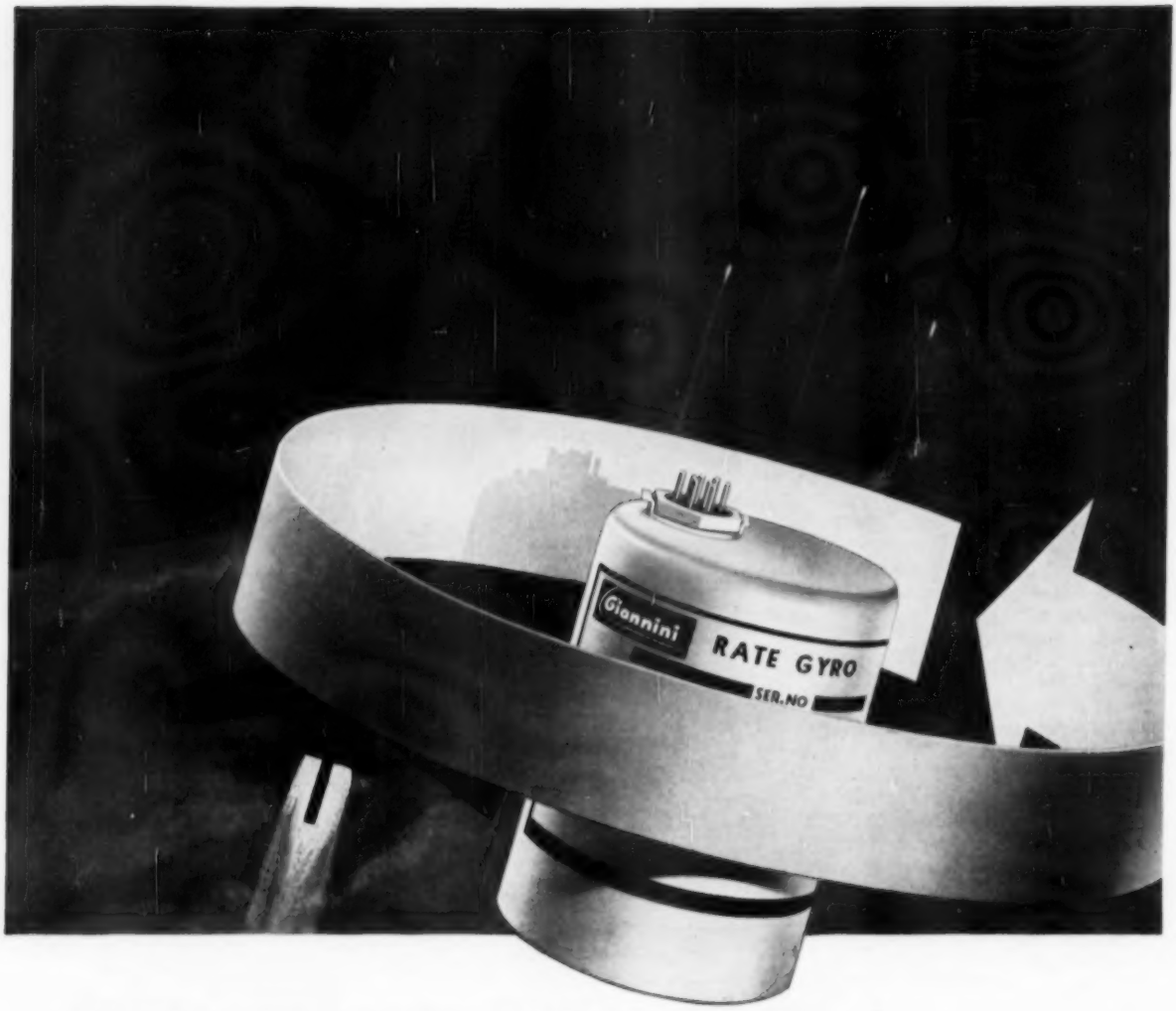

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Unceasing product evaluation and engineering improvement, plus a broadened control of the quality of its components have substantially improved the reliability of contemporary models. Latest versions now are available to withstand 100g shock, 15g vibration to 2000 cps, and have been qualified for 1000 hours of operation in ambient temperatures of 100°C.

Other important features of this 2 inch diameter unit are, exceptionally low cross talk over a rate range of ±15°/sec. to ±1000°/sec., high level potentiometer output, and a temperature controlled viscous damping system. High angular momentum 3-phase AC rotors are used in standard models with other types available on special order.

Write or call your nearest Giannini Field Engineering office for catalogs describing this and other "Proved Performance" Rate and Free Gyros.

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ment and winds automatically on take-up spool.

Machine can accommodate film length ranging from 1 ft. to 400 ft.

As first few feet of developed film come out of the machine they can be checked for correct developing time. If over-developed, machine can be accelerated to reduce developing time; if underdeveloped, machine can be slowed to increase developing time.

Triple-purpose rubber rollers over which film passes from tank to tank drive the film, agitate the various solutions and squeegee solutions from the film back into each tank to reduce carryover from one tank to another.

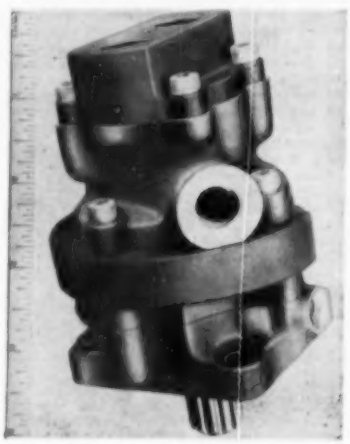
All chemical tanks are removable for cleaning and solution renewal.

Mini-Rapid 16 is made of stainless steel and weighs 70 lb. dry. It measures 27 in. long, 12 in. wide and 13 in. high. Price is $1,250.

OFF THE LINE

New, light-weight, piston-type cryogenic aircraft pump has been put on the market by Sundstrand-Denver.

Unit, designed to pump such liquified gases as nitrogen and liquid oxygen, has demonstrated its ability to pump liquid nitrogen pressures exceeding 3,000 psi. and speeds over 3,500 rpm. for over one hour with any type of



lubrication. Minor material change would make the pump compatible with liquid oxygen.

Pump, which is a modification of a standard Sundstrand hydraulic motor, has this performance data: displacement —0.130 cu. in./rev.; capacity at 3,000 psi.—90%; weight—2.5 lb.

Other, larger capacity cryogenic pumps are currently under development. Address: Sunstrand-Denver, 2480 West 70th Ave., Denver 11, Colo.

British tourist triple seat, Microcell T-34, has been designed to meet large-

scale tourist air travel. Features of the seat include: fold-up seat and arm rest to help passengers slide past each other, adjustable legs, individual meal trays fitted into the back of each seat and provision for plug-in-type meal tray. Triple seat's total weight is 75 lb. including meal trays, safety belts and other accessories.

New, closed-loop flow test system for airborne and ground test equipment using 90% hydrogen peroxide as test medium has been opened by Aerotest Laboratories. Operating range is up to 150 gpm. at 75 psi. Flow tests over a wide range of environmental conditions are possible. System is available to equipment makers for evaluation of rocket and missile components. Address: College Point, L. I., N. Y.

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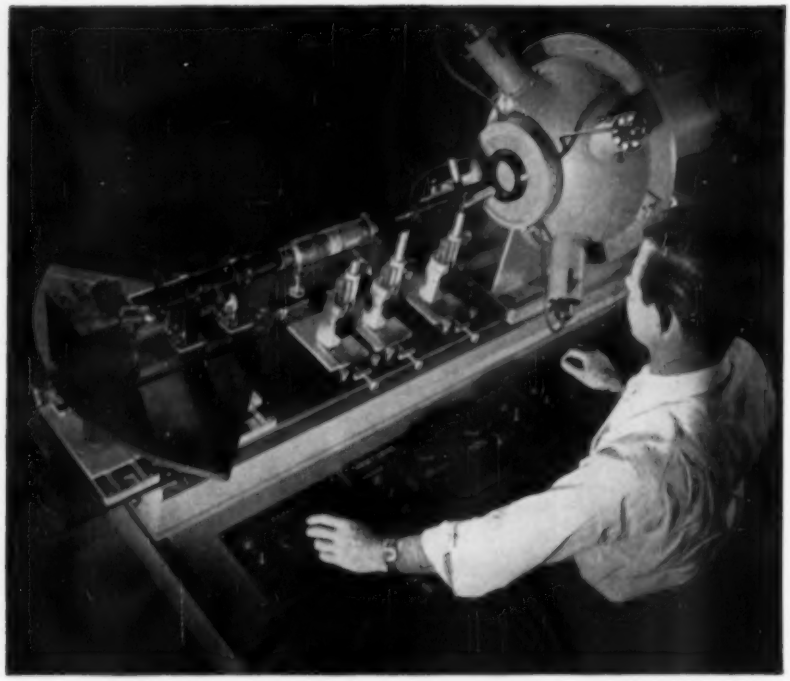

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Stock Transactions

Washington—Acquisition of $500,000 in 5½% convertible sub-debentures by Tom B. Slick, director of Slick Airways, Inc., his entire holding, and acquisition of 10,498 common shares of Slick common stock by T. B. Slick for a holding 84,545 has been reported by the Securities and Exchange Commission. Other transactions from Sept. 11 to Oct. 10 include:

Aero Supply Manufacturing Co. Inc. Acquisition of 300 common shares by H. E. Christensen, director, for a holding of 900.

Aeronca Manufacturing Corp. Acquisition of 100 common shares by Gordon J. Wolf, director, for a holding of 5,250, with Wolf holding 75 shares beneficially in a trust.

Air Way Industries Inc. Acquisition of 200 common shares by Edward Lamb, director, for a holding of 41,666; acquisition of 22 common shares by Edward Lamb Enterprises, beneficial owner under Lamb, for a holding of 42,985 with Dispatch, Inc., beneficial owner under Lamb, holding 14,357 common shares; acquisition of 209 common shares by Edward Lamb Enterprises, a direct beneficial owner in this transaction, for a holding of 387,248; acquisition of 200 common shares by Prudence H. Lamb, a direct beneficial owner, for a holding of 50,463; acquisition of 960 common shares by Woodruff, Inc., beneficial owner under Mrs. Lamb, for a holding of 8,820; acquisition of 56 common shares by Edward Lamb Enterprises, beneficial owner under Mrs. Lamb in this transaction, for a holding of 108,429 with Dispatch, Inc., beneficial owner under Mrs. Lamb, holding 5,835 common shares.

American Airlines Inc. Acquisition of 100 common shares by Edwin H. Herzog, director, for a holding of 500; disposal of 593 common shares by W. Nelson Bump, officer, leaving a holding of 1,000.

Atlas Corp. Acquisition of 100 common shares by Walter A. Peterson, officer, for a holding of 500; disposal of 500 option warrants by Walter A. Peterson, officer, leaving a holding of 2,300.

Avco Manufacturing Corp. Acquisition of 1,000 common shares by Lloyd P. Smith, officer and director, for a holding of 1,500; acquisition of 300 $2.25 preferred shares by James D. Shouse, officer and director, for a holding of 950.

Bell Aircraft Corp. Acquisition of 8,200 common shares by Equity General Corp., a direct beneficial owner, for a holding of 1,339,466; acquisition of 400 common shares by Leston Faneuf, officer and director, for a holding of 600 with trusts under Faneuf holding 120 common shares.

Bendix Aviation Corp. Acquisition of 500 common shares through exercise of option by Raymond P. Lansing, officer and director, for a holding of 5,098; acquisition of 200 common shares by C. C. Tillinghast Jr., officer, his entire holding.

Capital Airlines Inc. Acquisition of 2,000 common shares by Charles H. Murchison, director, for a holding of 10,132.

Consolidated Electrodynamics. Disposal of 500 common shares by Franklyn H. Donnell, director, leaving a holding of 12,000; disposal of 700 common shares by A. Charles Schwartz, director, leaving a holding of 200.

Continental Air Lines Inc. Acquisition of $40,000 in 4¼% debentures (1970) by Lawrence C. Ames, director, his entire holding.

Curtiss-Wright Corp. Disposal of 7,500 common shares by T. Roland Berner, director, leaving a holding of 4,700; disposal of 400 common shares by Frank H. Hankins Jr., officer, leaving a holding 4,100.

E. I. du Pont de Nemours & Co. Acquisition of 300 common shares by Walter J. Beadle, officer and director, for a holding of 5,716.

Fairchild Engine and Airplane Corp. Acquisition of 292 common shares by A. F. Flood, officer and director, for a holding of 1,475 with Flood, acting as trustee, beneficially holding 1,525 common shares.

General Dynamics Corp. Disposal of 700 common shares by Allen D. Marshall, officer and director, leaving a holding of 7,400; disposal of 5,000 common shares by Frank Pace Jr., officer and director, leaving a holding of 39,780; disposal of 700 common shares by Kenneth Stiles, officer, leaving a holding of 2,300.

General Electric Co. Acquisition of 1,350 common shares by George E. Burens, officer, for a holding of 5,400; acquisition of 1,500 common shares by John D. Lockton, officer, for a holding of 6,519; acquisition of 360 common shares, through exercise of option, by H. A. MacKinnon, officer, for a holding of 6,227; acquisition of 270 common shares by W. A. Mann, officer, for a holding of 880; acquisition of 2,000 common shares, through exercise of option, by D. L. Millham, director, for a holding of 8,409.

General Motors Corp. Disposal of 174 common shares by Albert Bradley, officer and director, leaving a holding of 5,660 with 99,912 common shares held beneficially through G. M. Shares Inc., under Bradley; disposal of 1,000 common shares by John F. Gordon, officer and director, leaving a holding of 4,874; disposal of 800 common shares by Henry M. Hogan, officer, leaving a holding of 22,051; disposal of 800 common shares by W. F. Hufstader, officer, leaving a holding of 18,419; disposal of 200 common shares by Ralph C. Mark, officer, leaving a holding of 800.

W. R. Grace & Co. Disposal of $200,000 worth of 3¼% convertible debentures by D. Walter Robbins Jr., officer, leaving a holding of $1,000.

McDonnell Aircraft Corp. Acquisition of 400 common shares by G. C. Covington Jr., for a holding of 1,736; acquisition of 3,800 common shares by J. S. McDonnell, officer and director, for a holding of 246,954 with McDonnell, acting as guardian, beneficially holding 104,871 and McDonnell, acting as trustee, beneficially holding 302 common shares; acquisition of 200 common shares by J. E. Webb, director, for a holding of 900.

National Aviation Corp. Disposal of 200 common shares by Elmer Wellin, director, leaving a holding of 1,000.

Northrop Aircraft Corp. Acquisition of 500 common shares by Robert R. Miller, officer, for a holding of 1,000; acquisition of 100 common shares by A. G. Rubel, director, his entire holding; disposal of 200 common shares by William Larrabee, officer, leaving a holding of 300.

Northwest Airlines. Disposal of 500 common shares by A. J. Weatherhead Jr., director, leaving a holding of 2,650.

Nuclear Corp. of America. Acquisition of 300 class A shares by Andrew H. Bergeson, director, for a holding of 400.

Pacific Northern Airlines. Acquisition of 300 common shares by Harold A. Olsen, officer, for a holding of 8,200.

Pan American World Airways. Acquisition of 1,875 capital shares through exercise of option by Samuel F. Pryor, officer and director, for a holding of 13,757; acquisition of 250 capital shares, through exercise of option, by Clarence M. Young, officer, for a holding of 4,000.

Radio Corp. of America. Acquisition of 100 common shares by Andre Meyer, director, for a holding of 9,100; disposal of $10,300 in 3½% convertible subordinate debentures by Frank M. Folsum, director, leaving a holding of $80,000.

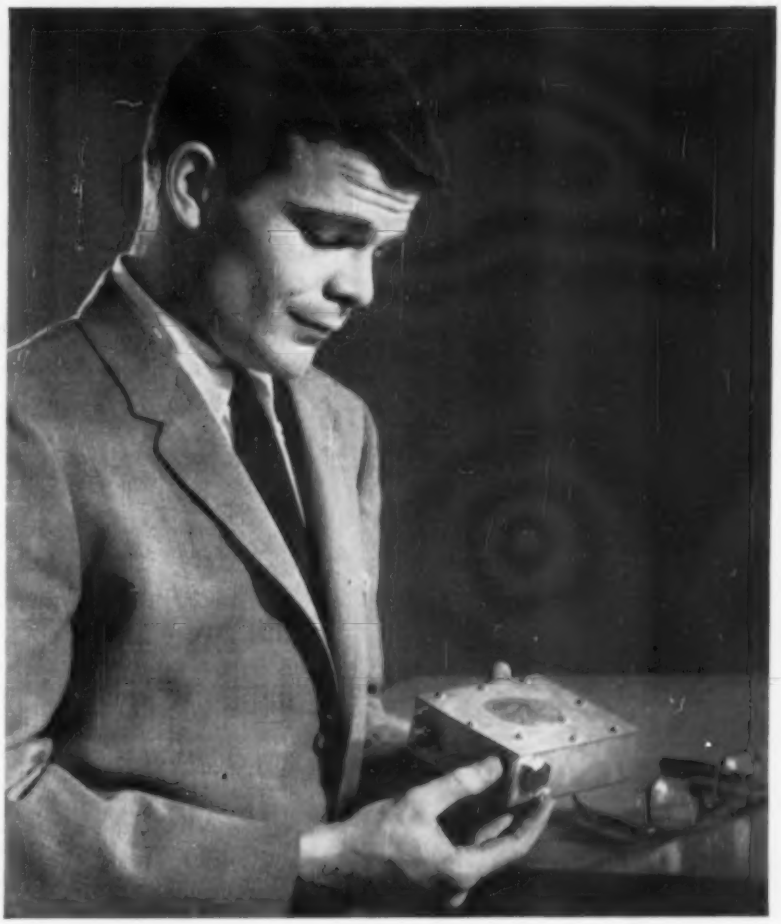
Republic Aviation Corp. Acquisition of 100 common shares by Walter G. Bain, officer and director, for a holding of 203.

Seaboard and Western Airlines. Disposal of 200 common shares by Douglas M. Ammann, director, leaving a holding of 6,600; disposal of 300 common shares by Samuel I. Fondiler, officer, leaving a holding of 3,048.

Solar Aircraft Co. Disposal of 1,000 common shares by Herbert Kunzel, officer and director, leaving a holding of 3,510.

Sperry Rand Corp. Disposal of 5,000 common shares by Francis J. McNamara, officer, leaving a holding of 5,500.

Western Air Lines Inc. Acquisition of 1,000 common shares by W. H. Gonyea, director, for a holding of 3,900.



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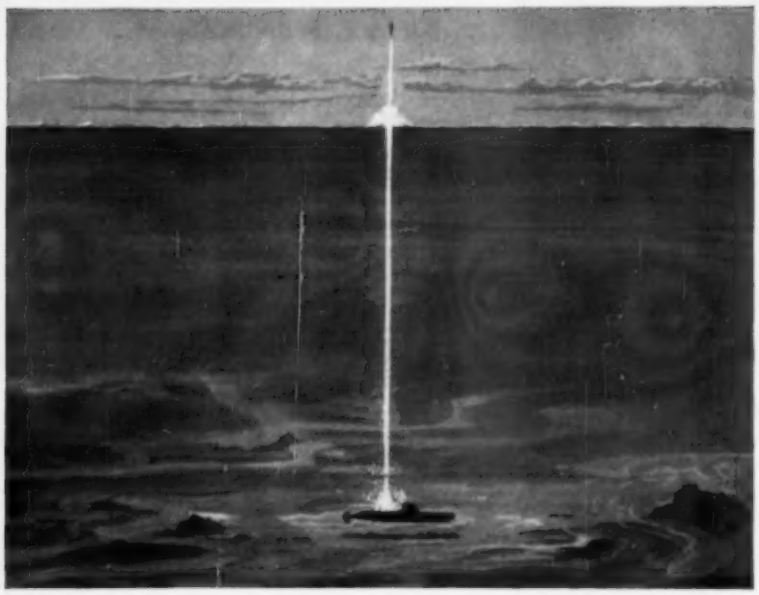
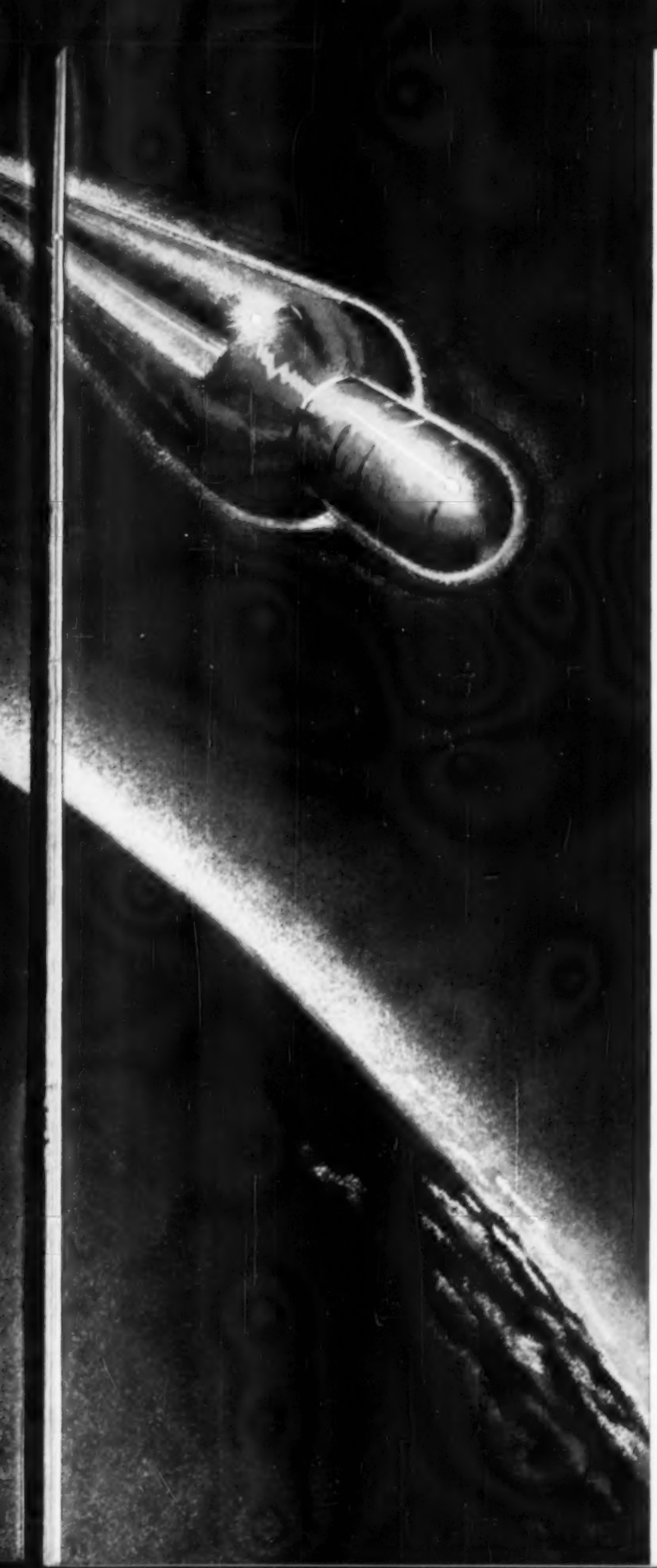


FROM A HIDDEN SITE, deep in the ocean, 1500-mile Polaris missile can be shot to the surface and hurtled through space at tremendous speeds. Hard to detect, mobile launching sites make defense against Polaris practically impossible.



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Typical of the problems being solved in perfecting the Polaris missile are intricate guidance and fire control systems being developed by the U. S. Navy, the Massachusetts Institute of Technology, and the General Electric Company.

With Polaris, the Navy adds ballistic seapower from the hidden depths of the ocean to its traditional advantages of speed, mobility and long range in helping defend America. ***Missile and Ordnance Systems Department, General Electric Company, Pittsfield, Massachusetts.*** 224-13

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WHAT'S NEW

Reports Available:

The following reports were sponsored by The Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Research on the Influence of Ultrasonic Waves on Metallic Corrosion—by A. Reggiori and T. Songa, Breda Institute di Richerche Scientifiche Applicate, Milan, Italy for European Office, Air Research and Development Command, U. S. Air Force. Nov. 1956: $2.25; 83pp.; (PB 121964).

The Corrosive Effects of Protein-Type Foam-Forming Concentrates on Common Metals and Dissimilar Metal Couples—by H. B. Peterson and J. C. Burnett, Naval Research Laboratory. June 1957: $.75; 22 pp.; (PB 131018).

Corrosion of Metals in Tropical Environments: Part 1—Test Methods used and Results obtained for Pure Metals and a Structural Steel—by A. L. Alexander and others, Naval Research Laboratory. June 1957: $1.25; 46pp.; (PB 121952).

The Corrosion Products of Iron and Steel: A Selected Bibliographic Survey with Abstracts—by M. J. Bochm, Naval Research Laboratory, June 1955: $.75; 28pp.; (PB 121963).

Ferroelectric Materials Survey with Particular Interest in their Possible Use at High Temperatures—by C. F. Pulvari, Catholic University of America for Wright Air Development Center, U. S. Air Force: $2.00; 74pp.; (PB 121949).

Nonmetallic Ferromagnetic Materials: Part VII—Microwave Ferrites—by H. C. Rothenberg and E. B. Mullen, General Electric Co. for Wright Air Development Center, U. S. Air Force: $1.25; 49pp.; (PB 131053).

An Expander-Compressor Method of Air Cooling—by R. S. MacDonald, Cornell Aeronautical Laboratory, Inc. Dec. 1954: $.75; 21pp.; (PB 121926).

Research of the Flammability Characteristics of Aircraft Hydraulic Fluids—by M. G. Zabetakis, A. L. Furno and J. J. Miller, Jr., U. S. Department of the Interior, Bureau of Mines for Wright Air Development Center, U. S. Air Force: May 1957: $1.00; 34 pp.; (PB 131193).

Injection and Combustion of Liquid Fuels—by A. A. Putnam and others,

Teracruzer Delivery

This 7½ ton eight-wheel drive Teracruzer which hauls TM-76 Matador guided missiles (AW Jan. 28, p. 30) and supporting equipment over rough terrain on pillow tires is emerging from a Lockheed C-130 Hercules turboprop transport after delivery to Pinecastle AFB, Orlando, Fla., for use by the 4504th Tactical Missile Wing. Vehicle is built by Four Wheel Drive Auto Co., Clintonville, Wisc.

Battelle Memorial Institute for Wright Air Development Center, U. S. Air Force. Mar. 1957: $9.00; 786pp.; (PB 131008).

Spark Ignition of Fuels Mists-Development of Apparatus and Preliminary Results–by A. E. Weller, Battelle Memorial Institute for Wright Air Development Center, U.S. Air Force. Dec. 1956: $1.00; 31pp.; (PB 121855).

Research of the Flammability Characteristics of Aircraft Hydraulic Fluids–by M. G. Zabetakis, A. L. Furno, and J. J. Miller, Jr. U. S. Department of the Interior Bureau of Mines for Wright Air Development Center, U. S. Air Force. May 1957: $1.00; 34pp.; (PB 131193).

Design Methods for Magnetic Amplifiers and Saturable Reactors–by J. R. Walker, and M. Frank, Wayne Engineering Research Institute for Wright Air Development Center, U. S. Air Force. July 1956: $9.50; 628pp.; (PB 121765).

A Transient-Controlled Magnetic Amplifier–by G. Schohan, U. S. Naval Ordnance Laboratory. Mar. 1956: $.75; 23pp.; (PB 131011).

Development of Non-Destructive Tests for Structural Adhesive Bonds: Part 5–by J. S. Arnold, Stanford Research Institute for Wright Air Development Center, U.S. Air Force, February 1957: $1.75; 62pp.; (PB 131046).

Development of Infrared Defrosting for Aircraft Canopies–by L. Bennett and others, New York University for Wright Air Development Center. Mar. 1957: $2.50; 96pp.; (PB 131032).

Publications Received:

Balloons to Jets–by Howard L. Scamehorn–Pub. Henry Regneryy Company, 20 W. Jackson Blvd., Chicago 4, Ill. $5.00; 271pp.

Until half a century ago, aeronautics was little more than a showmanship, today it is an essential part of life. Balloons to Jets is the exciting story of the meteoric growth of our aviation field.

Handbook of Noise Control–edited by Cyril M. Harris–Pub. by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York. $16.50; 40-12pp.

A comprehensive handbook which discusses in detail the nature of noise, its measurement, and techniques of its control in buildings, industry, transportation, and the community.

Big Business and Human Values–by Theodore V. Houser–Pub. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York. $3.50; 103pp.

Sears, Roebuck and Company, presents an intimate story of "big business" experiences in successfully blending business objectives and high regard for people as humans in its operations.

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LATEST ADDITION to Beech line is four-place Travel Air, starting at $49,500. Company expects to sell $9 million worth in 1958.

Beech Reveals 1958 Line, Big Backlog

By Erwin J. Bulban

Beech Aircraft Corp. now has a firm backlog of more than $14.8 million worth of 1958 model business aircraft orders, company president Mrs. O. A. Beech, revealed after a recent annual sales meeting. The meeting was held for 375 distributor and dealer personnel from the United States and 20 foreign countries at Wichita, Kans.

For the first time in several years, company officials declined to predict total Beech executive aircraft sales dollar volume for Fiscal 1958—probably bearing in mind the current uneasy business climate. Indications are that it has high hopes that introduction of a new model to its line—the light twin four-place Travel Air—will play a major role in raising its Fiscal 1958 business aircraft dollar volume to continue upward trend of past years. Frank E. Hedrick, Beech vice president-coordinator, estimates that Travel Air sales in Fiscal 1958 will total some $9 million.

Hedrick also noted that the company has a combined commercial and military backlog topping $113 million, an increase of $10 million over the same period last year.

Distributors and dealers were formally introduced to product improvements in the company's 1958 business aircraft line, which includes:

- **Travel Air,** priced at $49,500 in the standard version.
- **Bonanza J35,** priced at $24,300.
- **Twin-Bonanza F50** (supercharged Lycomings), starting at $88,000 and the Twin-Bonanza D50A (high-compression Lycomings), which starts at $77,000.
- **E18S Super 18,** which is priced at $117,975.

Only airplanes to escape price increases—aside from Travel Air, which is being introduced this year—were the Twin-Bonanza models. Bonanza, which has a new, more powerful engine, is up approximately $1,650; Super 18 has jumped $11,000.

Travel Air Market

Designed to fill the big price gap between the Bonanza and Twin-Bonanzas and also to meet competition from Piper and Cessna light twins, the new Travel Air features considerable use of components from existing Beech airplanes, including the Air Force and Navy T-34 Mentor trainer, a design factor that resulted in a short development-to-production cycle.

Basically, the airplane is a 200-mph. cruise type with nonstop range exceeding 1,400 mi. on 112 gal. of fuel. Airplane has been designed to utility load factors and tested to an ultimate load factor of 8. Structure is strong enough to take a 45-ft./sec. gust, the company reports.

Wings are composite assembly of Bonanza H35, Twin-Bonanza and T-34B assemblies modified to accommodate nacelle and fuel tank components. Fuselage is basically an H35 structure, except for an entirely new nose section forward on the Bonanza's firewall. Tail is primarily a modified T-34B section, with a number of components used virtually unchanged. Landing gear comprises modified T-34B units.

Travel Air is available with several different radio-communications equipment packages. Package No. 1, which weighs 108 lb. installed and costs $12,475, provides Aircraft Radio Corp. F-13A amplifier, ARC 15E omni, ARC type 21A ADF, ARC T-20 20-channel transmitter and T-21 10-channel transmitter, ARC R-32 receiver, Wilcox 700B glide slope and three-light marker beacon receiver. Package No. 2, weighing 51 lb. and costing $4,925, includes the ARC T-20, ARC 15E omni, ARC 20A marker beacon receiver, micro-

phone and headset and ARC F-13A.

Radio Package No. 3 weighs 24 lb. installed and costs $1,395. It includes a Narco VTR-2B Omnigator. Package No. 4 has a Lear LTRA-6T6 VHF communications set.

Also available for factory installation in conjunction with the above equipment is the Lear ADF-12E, with Package No. 3 or 4, at an installed weight of 28 lb. and cost of $1,225; ARC-21A ADF with Package No. 2 or with 3 if Narco VC-27B Simplexer is not installed, at weight of 24 lb. and cost of $3,175; Narco VC-27B available only with Package No. 3, and the Lear Omnimeter, available only with Package No. 4. Latter units weigh 14 lb. and 4 lb. respectively, cost $900 and $550.

Customers can also get auxiliary wing fuel tanks—two 31-gal. units replacing two 17-gal. tanks—at weight increase of eight pounds and cost of $725.

1958 Bonanza

Biggest feature of the 1958 Bonanza is the switch to a direct fuel injection system, on the new 250-hp. Continental IO470-C engine, providing 10 additional horsepower.

It can be expected that the elimination of the carburetor—and the problem of icing in this critical area—will be followed in other business aircraft. Cessna, for example, has been flight testing such a fuel system for some time in its light twin 310.

In addition to icing problem elimination, such a system also offers improved fuel distribution for smoother engine operation, lower induction system losses, providing higher power ratings and cruise rpm.

Additional power and the new fuel system will put these important marketing points in the hands of Beech distributors and dealers:

- **High speed of 210 mph.** at sea level, compared to 206 mph. for last year's H35. Maximum cruise speed at 75% power is now 200 mph. at 7,000 ft., compared to the earlier model's 196 mph. Cruise speed for the J35 is 195 mph. at 65% power at 10,000 ft. instead of 190 mph. at 8,000 ft. on the H35.
- **Service ceiling** for the J35 is 21,300 ft., compared to approximately 19,800 ft. for the H35.
- **Useful load** of the J35 has been increased to 1,080 lb., compared to 1,067 lb. for H35 without increasing the gross weight of 2,900 lb. With full tanks, new available weight for passengers and baggage is 830 lb., 20 lb. higher than on the H35.

In design, the J35 is very similar to the previous H35. The elevator trim tab system has been changed by removing the forward bungee spring and increasing aft bungee spring tension. Bungee system now acts as an elevator

FUEL INJECTION ENGINE, eliminating carburetor icing, is feature of $24,300 J35 Bonanza.

CLEANED UP COWLS on Twin-Bonanza are result of revising breather and vent line.

DETAIL CHANGES, rather than basic revisions, mark 1958 E18S, which starts at $117,975.

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Beech Program For MS-760 Jet

Complete sales and service program to handle distribution of Morane-Saulnier four-place twin-jet executive airplanes is being developed by Beech Aircraft Corp. with expectation of selling a number of the airplanes in the western hemisphere, Aviation Week has learned.

First MS-760 for executive use has been sold to Timken Roller Bearing Co. (AW Dec. 2, p. 98). Beech plans to have four airplanes available for 1958 delivery, "a larger number" in 1960. Company plans to announce its marketing plans, including price, in about 30 days.

Policy will be to offer a complete package program, comprising technical training for customer's maintenance personnel, servicing equipment such as special tools, jacks and hoists and the like, small expendable spares. Beech will also stock spare 880-lb. thrust Turbomeca Marbore engines and parts in Wichita, offer replacement service via airfreight.

Service package will be included in the price, which will be under $300,000, according to informed sources close to the company. Planes will be imported from France. Current planning calls for Fiscal 1958 sales to be handled directly by the factory, with some arrangements probably being made later to compensate distributors who originate sales, Aviation Week was told.

MS-760 currently is finishing Civil Aeronautics Administration Type Certificate approval procedures; the company expects to have this completed in about a month.

down spring with trim tab control assists to relieve elevator force exerted by the down spring for a given trim condition.

More effective elevator is provided with a 40% increase in tab area. Additional effectiveness is provided in the elevator for any forward center of gravity loading because less tab travel is required to obtain the proper trim, Beech notes. Up travel remains the same while down travel is 23 deg., 3 deg. less than previously.

Instrument Panel

Some differences will also be apparent on the instrument panel. The small fuel pressure gage in the engine cluster has been replaced by an additional fuel quantity gage, making for one gage for main tanks and one for auxiliaries. Instruments are thus marked and this arrangement now requires only two readings, where four were required previously.

Engine fueled pressure can now be read on a 3½ in. dial calibrated in one-quarter pound increments, with face

marked in percentage and color for cruise conditions and in feet and color for takeoff. An auxiliary fuel pump switch and warning light have been added to the switch console and two controls (one on each side of the mixture) have been added for vents on the firewall, formerly controlled by the foot. Auxiliary electric fuel pump replaces the former handle wobble pump. Push-pull mixture control has been replaced by a vernier control and moved to directly below the center panel for easier adjustment.

Optional radio packages available with the J35 include:

- **Installation A**—Weight 27 lb. installed and price $1,300, providing Narco VTR-2 Omnigator.
- **Installation B**—Weight 53 lb. and costing $4,795, including ARC T20 transmitter, ARC 15E omni, ARC R20A marker beacon receiver and ARC F-13A cabin speaker amplifier.
- **Installation C**—Lear LTR-6TS weighing 25 lb. installed and costing $950.

Individual optional equipment can be fitted at the factory only in conjunction with the above packages: Lear ADF-12E with Installation A or C; ARC Type 21 ADF with Installation A or B, Narco VC-27, Simplexer with Installation A and Lear Omnimeter, with Installation C.

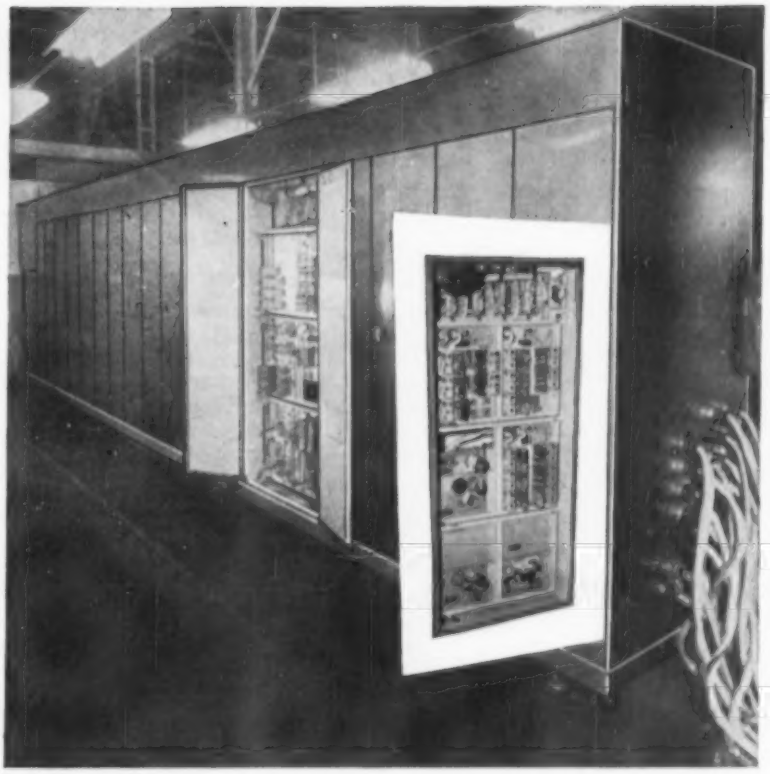
Beech is offering for the first time as factory installed optional equipment the new lightweight Tactair T-3 autopilot, with installed weight of nine pounds for $1,300.

1958 Twin Bonanzas

Detail improvements rather than major changes are featured in the 1958 Twin-Bonanza line. Engine nacelles have been cleaned up aerodynamically by removing the crankcase breather line from the top of the nacelle and rerouting it to just aft of the exhaust augmentor tubes. And, on Twin-Bonanzas equipped with small engine-driven vacuum pumps, the oil separation vent has been eliminated from the top of the nacelles by teeing the vent line into the crankcase breather vent line. This arrangement allows both lines to exhaust in the warm air region of the engine exhaust to eliminate possibility of vent icing, according to Beech.

The retractable entrance step mechanism has been improved; the power to actuate the step has been increased.

Oxygen installation has been revised, moving the bottle to the aft side of bulkhead station 211, providing more cabin or baggage area and allowing fitting of a remote filler valve to obviate need for removing the bottle for this service. On the D50A, "never-exceed" and "design cruise speed" markings on the airspeed indicator have been changed to the higher readings of the F50. Maximum flap extension



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*Erco also built the trailer.

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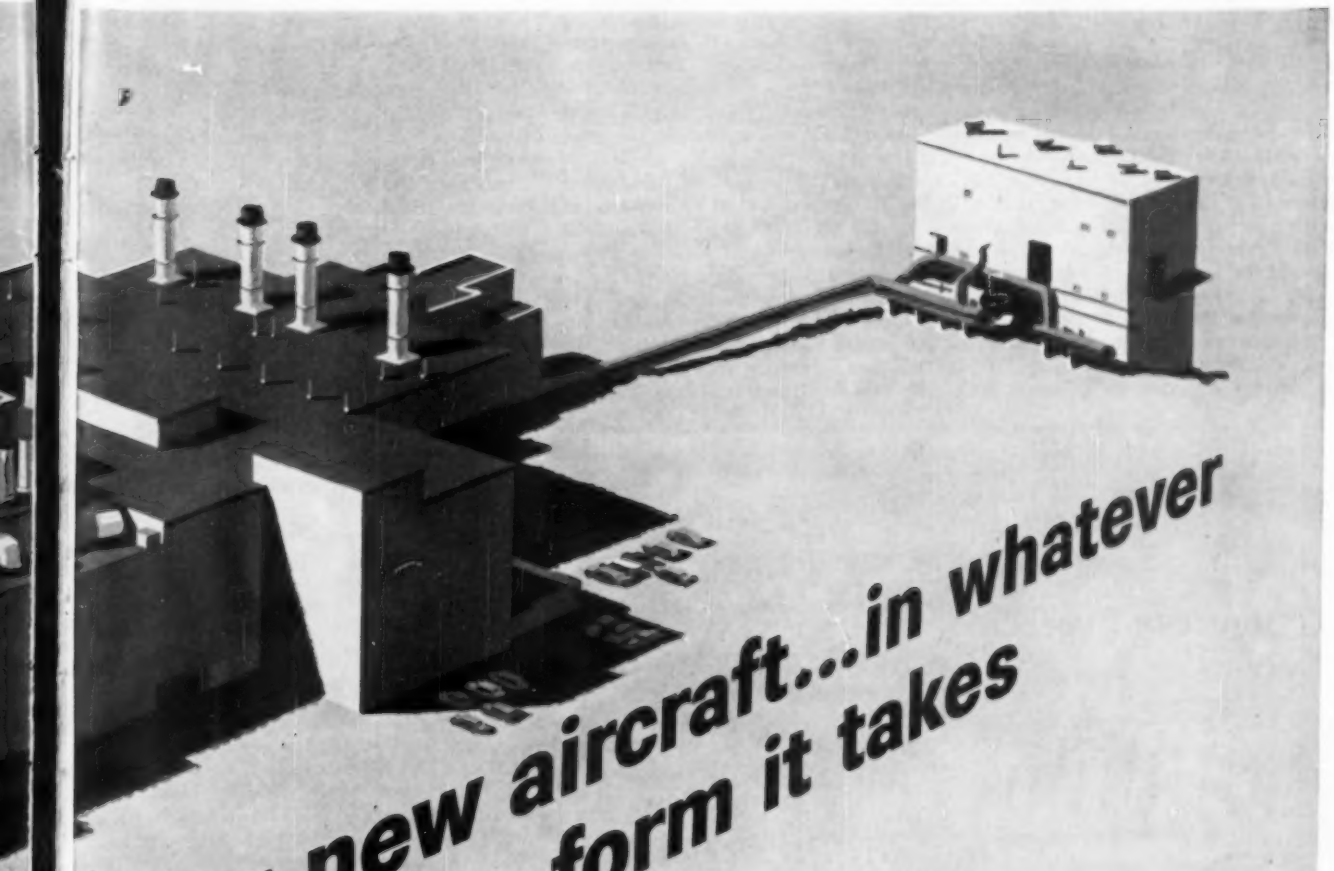

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speed has been raised 15 mph. to 150 mph.

Offered as optional equipment is a propeller unfeathering system, consisting of an accumulator which is charged when propeller control levers are in low-pitch at takeoff position. As propeller levers are brought back to cruise position, a valve closes, trapping oil under pressure in the accumulator. After a propeller is feathered, it can be brought back by merely returning the levers to low-pitch, releasing the pressure in the accumulator.

F50's engine model has been changed from GSO480-A1A6 to GSO480-B1B6, the change covering an oil-squirt feature which cools the pistons by spraying oil on the underside to reduce possibility of detonation and piston burning. D50A Twin-Bonanza engine model is changed from a GO480-C2C6 to a GO480-G2D6, incorporating the same change.

Considerable amount of radio equipment is optional on the Twin-Bonanzas. That for the F50 costs $5,288 and has an installed weight of 57.7 lb. This is Installation A, providing Collins 17L-8 90-channel transmitter, and ARC 15E omni, a Flite-Tronics CA-1A audio amplifier and Collins 37R-1 antenna. Installation B, costing $8,456 and weighing 94.5 lb., comprises Narco Sapphire 1016 90-channel transceiver, ARC 15E omni, Collins 17L-8 90-channel transmitter Flite-Tronics CA-1A, Narco 71144-101 antenna. Installation C costs $8,693 installed and weighs 90.9 lb.: consists of a Lear LTR-800 transceiver with 140 transmission and 240 receiver channels, ARC 15E, ARC T-20 Flite-Tronics CA-1A and Lear 2217A antenna.

Optional Gear

Optional gear offered with the above installations includes: ARC Type 21A ADF, Lear R-14D ADF, Flite-Tronics MB-3 marker beacon receiver, Lear 2200B marker beacon receiver, ARC type R-11A LF range receiver, ARC 15E for dual installation, Wilcox 700B 20-channel glideslope receiver, Collins 51 Z-2 marker beacon receiver and Collins 51 V-3 marker beacon receiver.

Installation D comprises this Wilcox layout: 705A 560-channel receiver, 707A 360-channel transmitter, 717B switching unit, 706A 560-channel omni receiver, 709B audio amplifier, 700B glidescope receiver, 702A marker beacon receiver, 715A dynamotor power supply and Collins 17L-8 90-channel transmitter and 37R-1 antenna.

Options to Installation D include: Wilcox 701A ADF at $4,518, weighing 31 lb.; Wilcox 706A omni for dual installation costing $5,387 and weighing 27 lb.; Wilcox 701A dual ADF and 706A omni at $9,043 and weighing 58 lb.; Wilcox 707A transmitter replacing 17L-8 and Wilcox 701A ADF costing $6,637 and weighing 38 lb.; Wilcox 701A ADF, 707A transmitter and 706A omni for $10,731 and weighing 65 lb.

Beech Model E18S shows very few basic changes over its proven design; a new 90,000 Btu. heating system has a blower for ground operations, permitting cabin to be heated while engines are off on ground. Improved ram-air windshield de-icing system is fitted as standard equipment.

Cabin rear bulkhead is removable for transporting special cargoes. Instrument panel is floating type, hinged for easier servicing.

New Argentine Twin Starts Flight Tests

Buenos Aires—A five-place light transport, powered by two pusher-mounted Lycoming 150-hp. engines, has begun flight test in Argentina. Designated the I.A. 45, the plane was built in Argentina's Fabrica Militar de Aviones.

Fuel capacity is 80 gal., providing a range of approximately 620 mi. Cruise speed is reported to be 161 mph. It is fully equipped for instrument flying. Wing span is approximately 45 ft., length about 30 ft. Plane is designed to land in less than 820 ft. Landing gear is a retractable tricycle type.

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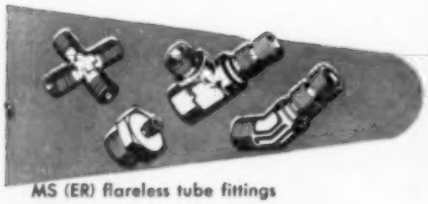
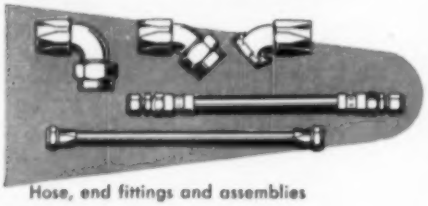
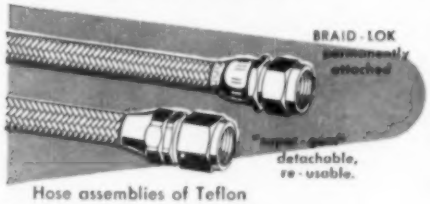


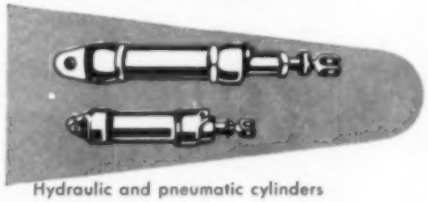
MS (ER) flareless tube fittings



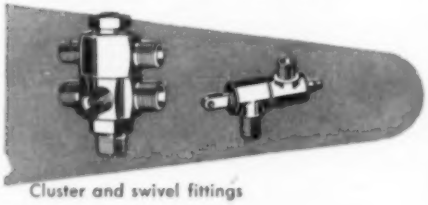
Hose, end fittings and assemblies



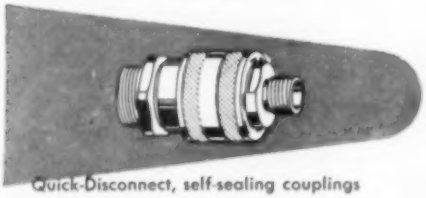
Hose assemblies of Teflon



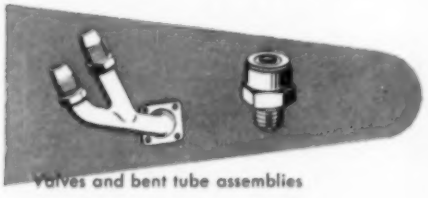
Hydraulic and pneumatic cylinders



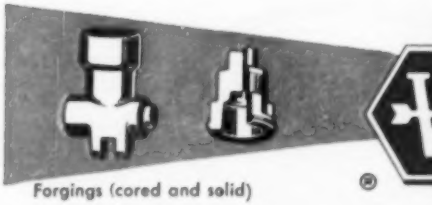
Cluster and swivel fittings



Quick-Disconnect, self-sealing couplings



Valves and bent tube assemblies



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Component Panels
Fire Control Systems
Range Adapters
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Gyroscope Systems

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Sales Push Urged for General Aviation

By Craig Lewis

Dallas—Blunt warnings that general aviation will have to present a united front and do a better job of selling itself were heard by delegates to the 18th annual convention of the National Aviation Trades Assn. held here recently.

Such warnings were given by both industry and government speakers during the three-day meeting of fixed base operators, aerial applicators and air taxi operators.

Convention was dominated by discussion of industry-government problems and relations in regulatory, military and agricultural fields.

Convention was also highlighted by the unveiling of a new crop sprayer/duster by Grumman Aircraft Engineering Corp. (AW Nov. 25, p. 32). After quietly touring aerial applicators in the southwest for several weeks, Grumman made its first public announcement of the new biplane at the NATA convention.

Civil Aeronautics Administrator James T. Pyle observed that the various representatives of general aviation have failed to come up with a cohesive, overall program for their segment of the industry as a basis for future planning.

Need Representative Program

"This disorganized approach has been neither effective nor has it won many supporters for the cause of general aviation," Pyle said.

"We need the benefit of your best thinking and organized participation in the planning sessions which lie ahead, but it must be representative of all of general aviation."

Pyle also took note of industry complaints about the CAA Supplemental Type Certificate program, admitting it is far from a satisfactory solution to the modification problem. "But I must also point out that general aviation is not without some responsibility for making the Supplemental Type Certificate necessary," he said.

"I am certain you would be appalled at the casual way some aircraft are modified to provide extra seats or greater cargo capacity with little regard for the structural or aerodynamic effects involved," Pyle observed.

Accident prevention was a leading topic of discussion for aerial applicators, and they were warned that "it is long past the time that accident prevention was given a high priority in your operational plans" by Charles L. Walker, flight operations specialist, CAA Region 4.

Walker told applicators their approach to accident prevention should be a sound business plan and organization, based on the knowledge of maintenance and operation of aircraft, and the know-how to best perform the job they have to do.

Outlining accident records in the eleven western states, Walker said there had been 100 accidents in 1954, 85 in 1955, 94 last year and 125 reported so far this year. Last year there were 12 pilot fatalities, and so far this year there have been 23 pilots killed.

Among resolutions passed by NATA was one aimed at improving distributor and dealer relationships. NATA will approach the Aviation Distributors and Manufacturers Assn. in an effort to form a joint committee for study and alleviation of problems in dealer-distributor relations. Another resolution was passed favoring negotiation of a joint national convention of NATA with other general aviation associations.

USAF Contracts

Air Force is continuing to contract the same share of its maintenance to commercial operators, but dollar volume is down because of budget stringencies, according to Maj. Gen. A. G. Hewitt, director, maintenance engineering, DCS-Materiel HQ. USAF. Gen. Hewitt pointed out that commercial operators were doing 71% of USAF maintenance work in Fiscal 1957, and they are doing the same percentage this year. But because of overall budget cuts, dollar volume has dropped from $967 million to $903 million.

Gen. Hewitt predicted that the volume of contract maintenance has reached a level which will not increase in the next few years. He said that leveling of aircraft inventory and increased budgetary restrictions must cause all concerned with contract maintenance to make a close appraisal of workloads and consider the possibility of taking on civilian work along with military business.

Discussing effects of budget limitations, Gen. Hewitt said that the Air Force has discontinued IRAN (inspect and repair as necessary) of second line aircraft, and these aircraft will not get USAF depot type maintenance. When such low priority aircraft as B-25s and C-45s become unsafe, they will be phased out of the inventory.

Problems of maintenance and repair of Army aircraft were reviewed by Brig. Gen. William B. Bunker, commanding general, TSMC. Overhaul of Army aircraft and components has been done by USAF in the past, and the Army has assumed responsibility for it this year.

Army needs to train maintenance units that are capable of moving overseas in an emergency, Gen. Bunker said, and thus current policy is to conduct organization and field maintenance with Army resources. For depot maintenance and repair, Army depends entirely on commercial contractors.

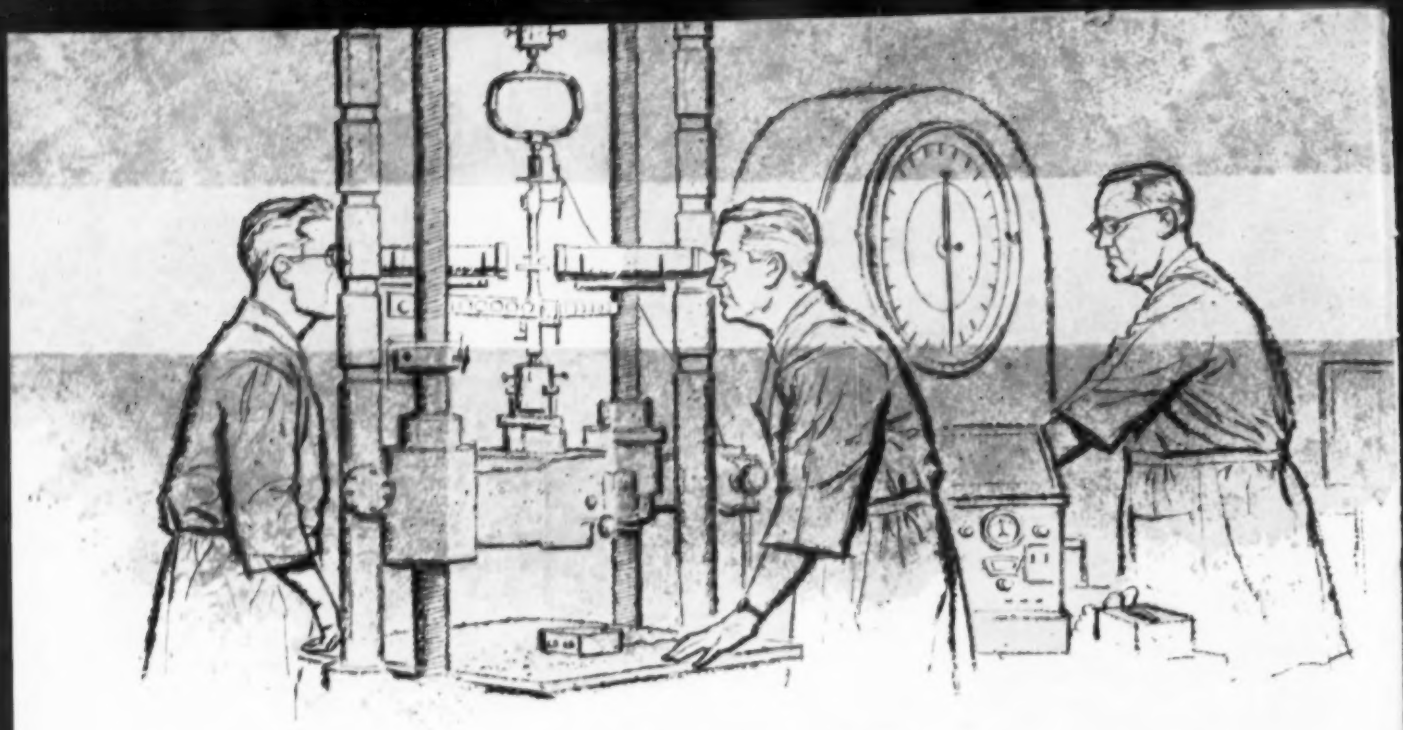
Contracted Overhaul

On the issue of overhaul work done by prime manufacturers, Gen. Bunker noted that the Army favors returning new components to the manufacturer for repair because he has been responsible for the basic design and can benefit from examining the equipment after it has been used.

Once the inevitable bugs have been worked out, Gen. Bunker said, the Army is primarily interested in "prompt and proper overhaul of the component or aircraft and its return to a usable status." He said that no special consideration goes to the manufacturer at this point, and that the work goes to

Focke-Wulf Builds Italian Trainers

First Piaggio P. 149 trainer, built under license by Focke-Wulf GmbH., Bremen, is handed over to the West German Federal Defense Ministry. P. 149 primary trainer has a 275-hp. Lycoming engine, top speed of 187 mph.



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Bunker noted that as the size of Army aircraft increases, dollar value of contract maintenance will increase. He also remarked that the work volume depends on how much maintenance is returned from overseas points and that if the bulk of this work is returned to the U. S., contract maintenance volume will increase.

Traffic Self Control

Resistance to the general trend toward more complex and rigid air traffic control rules and systems was evident in a resolution proposed by William J. Lotzer, president of National Air Taxi Conference. The plan for a so-called "self-controlled" instrument flight system was not officially adopted by NATA, but was referred to a committee for study and a report next year.

Basis of the self control system would be the establishment of a system of TVOR stations to be used with a set of minimum ceiling and visibility rules. A pilot would fly to the TVOR, then circle for, say, two minutes while observing the bottom of the cloud layer. If no traffic appeared or entered the cloud layer, the pilot would have the legal right to climb through the overcast along a designated track to "on top." Flight could proceed from there VFR.

At destination, pilot would approach the TVOR, observe the top of the cloud layer for a specified period, then descend on a designated heading through the overcast. Plan was outlined by James Herrick, fleet sales research, Cessna.

Purpose is to allow the general pilot to escape the complexities of formal air traffic control procedures. Herrick observed that after such a plan was in effect for a while, pilots using more complex ILS systems would want to use the self control system in all but the worst weather because of its simplicity and safety.

Air Taxi Operations

National Air Taxi Conference reported a membership of 138 operators in 1957, a gain of eight over the previous year. During the year, NATC members decided to increase rates from 20 cents to 25 cents per aircraft mile, and mileage and zone rates have been changed accordingly.

NATC reports air taxi operators carried 97,540 passengers during the year ending September, 1957. Load factor in this period was approximately 2.7, and operators flew 6,502,461 revenue miles and made 37,368 revenue flights.

Discussing airways and airport problems, Joseph T. Geuting, Jr., manager, Utility Airplane Council of Aircraft Industries Assn., praised the joint effort of the General Aviation Facilities Planning Group in preparing its report for White House study on aviation facilities planning (AW May 20, p. 127). But he also observed that considerable public support will be necessary "and we are going to have to be pretty mature in our approach and adept in our handling of general aviation in our dealings with government officials and legislators, with aviation's other segments, airline and military, and above all, in our relations with the general public."

Geuting said that general aviation is in a better position to sell the nation on the value of aviation because the pilot and user is a public citizen, and likely a very influential one. This factor gives general aviation a better grass roots position from which to do its selling job, he said.

Suggesting two specific solutions to airport problems, Geuting proposed that airports recognize the ability of small general aircraft to land on short runways and thus establish separate traffic patterns and allow simultaneous landings of transport and general aircraft. He also suggested construction of flight strips along highways.

New Owners

In the marketing field, Geuting said that sales efforts should be reaching more new owners. He pointed out that 73% of aircraft sold go to people who already own aircraft.

"We are not an industry which has saturated its market and depends wholly on obsoleting old models to create new sales," he said.

Industry has the responsibility to sell the concept of aviation, according to Dr. Leslie L. Thomason, director of air age education, Cessna Aircraft Co. He told NATA delegates that selling aviation involves telling the story over and over to all segments of the U. S. public.

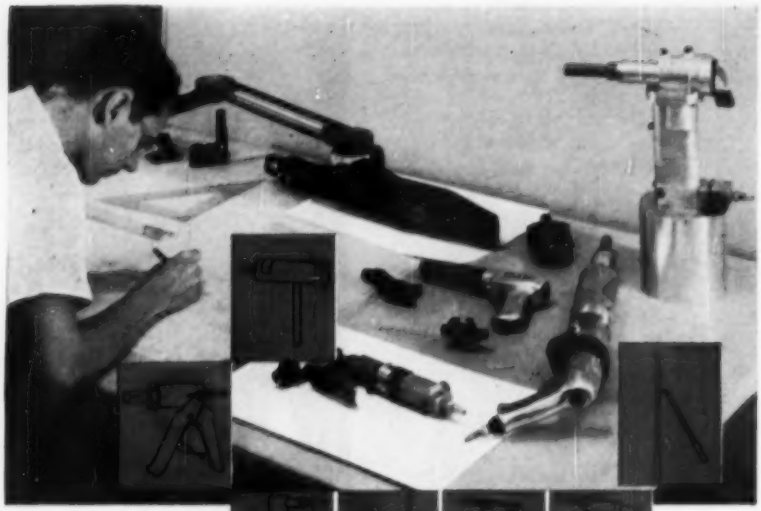
Selling the spectacular is a mistake, Thomason said, but aviation should sell itself on the basis of being indispensible, commonplace, routine, part of American living and modern business.

Rotor Craft Changes Throttling Controls

Changes are being made in rotor-tip-mounted rocket motor throttling systems of Rotor Craft's one-man strap-on "Pinwheel" helicopter as a result of analysis of a crash recently of the novel machine during a demonstration flight at Van Nuys Airport, Calif.

Company test pilot Richard Whitehead, who suffered a fractured right ankle, severely sprained left ankle and a damaged bone in his left foot, was able to provide vital clues as to cause of the accident. According to Whitehead, he had just refueled and taken off for a demonstration of the Pin-

ENGINEERS: *Contact our Technical Placement Manager for employment data.*



Prototypes of new special tools for installing Cherry Blind Rivets and Lockbolts are shown in the Cherry Research and Development Department.

Special Tools

for building tomorrow's aircraft being developed today by Cherry research

Higher speeds and operating temperatures of aircraft, missiles and rockets of the future demand fasteners with greater resistance to the stresses imposed upon them than ever before.

Installation of these high strength Cherry Rivets and Lockbolts* will require new special tools such as those now in the development stage in the Cherry Research and Development Department.

This activity—anticipating the needs of the aircraft industry and the military—is an old story with Cherry. For years, Cherry engineers and technicians have devoted themselves to a single objective—the production of better aircraft fasteners and the tools for installing them.

Tools for solving specific problems—tools for efficient production fastening—all are developed and produced in the Cherry plant at Santa Ana which is devoted exclusively to the production of fastening equipment for the aircraft industry.

For information on the most efficient fastening methods for your operation—write Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, California.

*Licensed under Huck patents RE 22,792, 2,114,493, 2,527,307, 2,531,048, 2,531,049 and 2,754,703

CHERRY RIVET DIVISION

Townsend Company

wheel's maneuverability when the rotor began overspeeding. In Whitehead's words:

"I immediately began closing the throttle, but it didn't work. I then closed the shut-off valve to stop the flow of fuel to the rotor rockets. In an instant the rotor began running wild and the tachometer jumped from a normal cruising speed to almost 1,000 rpm. I was about 50 ft. high at the time, and realizing that the rotor blade would disintegrate at slightly more than 1,000 rpm., I immediately began trying to land. The last time I checked the tachometer, it read 1,000 rpm. and I expected the rotor blades to carry away at any instant. Then I hit the ground."

Rotor Craft president Gilbert Magill reports that rebuilding has started and the helicopter should be flying again soon.

Project was developed for the Navy and the firm has developed some 10 missions that it can perform. In addition, Rotor Craft says that it receives 10-20 inquiries weekly from civilians who say that they are interested in purchasing the craft. Company says it will await Navy approval before building a commercial version.

PRIVATE LINES

Two Scottish Aviation Twin Pioneer STOL transports have been ordered by Fison-Airwork, Ltd., for airlift support to Shell-BP Petroleum Development Co., in Nigeria.

New Cessna dealers: Newark Air Service, Inc., Newark Airport, N. J., will cover a three county area in New York-New Jersey; DeKalb Aviation Corp., Atlanta, is new distributor in Georgia.

Doman Helicopters, Inc., Danbury, Conn., has been designated an approved aircraft repair station by Civil Aeronautics Administration with limited ratings for performing airframe overhaul and inspection on helicopters.

Twelfth Annual All-Woman Transcontinental Air Race (Powder Puff Derby) will begin at Montgomery Field, San Diego, Calif., July 4 and terminate at Charleston, S. C., Municipal Airport July 8. Aircraft must arrive at Montgomery Field by July 1 for impounding and inspection. Co-sponsors are San Diego and Carolina chapters of Ninety-Nines and Chambers of Commerce of San Diego and Charleston. Some 50-60 airplanes and more than 100 women pilots are expected to enter. For details write: Headquarters, All-Woman Transcontinental Air Race, 2611 E. Spring St., Long Beach 6, Calif.

WHAT ARE AMWELD FLASH WELDED RINGS?

They are rings that offer savings of critical materials. Bar stock formed and flash welded uses considerably less material than rings made by other methods.

They are rings formed, flash butt-welded, and shaped into the finest quality circular weldments available.

They are rings that offer additional manufacturing savings. Since the rings are closer to the desired finished cross section, it is less expensive to machine them to a final dimension. Oh yes, Amweld will machine them for you.

They are rings made by a company with experience in design. We can help you select a mill-rolled or extruded shape that is even closer to the finished ring dimension. This can give you additional savings.

Yes, Amweld flash-welded rings can give you extra profit from savings on material and machining time. Amweld rings can be made of most weldable ferrous or non-ferrous metals in sizes from 4 to 96 inches.

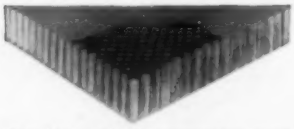
AMERICAN WELDING

THE AMERICAN WELDING & MFG. CO. • 420 DIETZ ROAD, WARREN, OHIO

MANAGEMENT
is known by the company it keeps

Youthful, aggressive management has guided Rohr straight to the top within America's great aircraft industry. Today, in addition to making over 30,000 different aircraft parts, Rohr shoulders a heavy responsibility to the future of flight in the field of new and vital structural components.

Rohr management is proud of the company it keeps — the company now famous as *the world's largest producer of ready to install power packages for airplanes.*



Rohr leads in high-temperature structure programs such as development and manufacture of brazed stainless steel honeycomb sandwich panel structure.

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES

ROHR
AIRCRAFT CORPORATION

Main Plant and Headquarters: Chula Vista, Calif. • Plant: Riverside, Calif. • Assembly Plants: Winder, Georgia; Auburn, Wash.

Army Contracts

Washington—Following is a list of unclassified contracts for $25,000 and over as released by Army Contracting Offices:

ARMY ENGINEER DISTRICT, WALLA WALLA, Corps of Engineers, Walla Walla, Wash.

Lord-Carrol, Portland, Ore., constructing two ready shelters using government furnished structural metalwork and pocket doors at Glasgow AFB, Mont. (IFB ENG-45-16458-3), $262,852.

Sletten Construction Co., Great Falls, Mont., constructing one ready aircraft shelter using government furnished metalwork and pocket doors at Malstrom AFB, Mont. (IFB ENG-45-164-58-3), $235,000.

ARMY ENGINEER DISTRICT, SEATTLE, Corps of Engineers, Seattle.

Refer Construction Co., Miles City, Mont., erection of tower No. 5, Mt. Hebo AFS, Ore., contract DA-45-108-ENG-4214 (IFB ENG-45-108-58-8), $63,176.

ARMY CORPS OF ENGINEERS, Office of the District Engineer, Jacksonville District, Jacksonville, Fla.

J. C. Harper Construction Co., Inc., Winter Park, Fla., construction of Complex 21 and support items (Bull Goose), WS-123A (FY-57) and change house and loading dock for armament test storage, WS-316A (FY-57), AFMTC, Patrick AFB, Fla. (Inv. No. ENG-08-123-58-9), $699,999.

Paul Smith Construction Co., Orlando, Fla., construction of booster storage igloos for complex, Navy FBM, (Polaris), AFMTC, Patrick AFB, Fla. (Inv. No. ENG-08-123 (Neg. 58-2), $143,175.

ARMY CORPS OF ENGINEERS, Office of the District Engineer, Tullahoma District, Tullahoma, Tenn.

L. E. Stevens Co. Inc., Newport, Ky., furnishing and installing Cooler No. 4 for the Supersonic Circuit of the Propulsion Wind Tunnel, Arnold Engineering Development Center, Tullahoma, Tenn. (IFB ENG-40-126-58-2), $111,590.

REDSTONE ARSENAL, Huntsville, Ala.

E. I. du Pont de Nemours & Co., Electrochemicals Department, Wilmington, Del., hydrogen peroxide, concentration 90% (purchase request: ME-20471-57), $98,790.

Tennessee Valley Authority, Chattanooga, Tenn., electrical energy for period Aug. 1 through Aug. 31, 1957, 8,361,716 KWH, $42,894.

Linde Co., Division, Union Carbide Corp., Birmingham, Ala., liquid oxygen, 30 million cu. ft. (purchase request ME-20469-57), $76,500.

Thiokol Chemical Corp., Trenton, N. J., development and delivery of modified XM10 rocket motors (purchase request CN-7-8), $179,984; research and development of two-level thrust propulsion unit for Hawk (SM-3) missile (purchase request CN-3-8), $153,957.

Linde Co., Division, Union Carbide Corp., Birmingham, Ala., liquid oxygen (purchase request ME-20469-57), 19 million sq. ft., $48,450.

ARMY ORDNANCE DISTRICT., Los Angeles, Pasadena, Calif.

Douglas Aircraft Co. Inc., Santa Monica, Calif., repair parts for Nike system, $70,507 and $58,955.

Hughes Aircraft Co., Culver City, Calif., Link improvement program, $55,577.

Hughes Tool Co., Culver City, Calif., development of Gul-Link and feeder, $466,-254.

Gilfillan Bros. Inc., Los Angeles, research and development work relating to Corporal Type III instrumentation, $39,896.

ARMY CORPS OF ENGINEERS, Office of the District Engineer, Philadelphia District.

Mt. Cuba Construction Co., Mt. Cuba, Del., construction of addition to rocket storage, checkout and assembly bldg., at Dover AFB, Del. (contract No. DA-36-109-ENG-6662), $197,608.

ENGINEER OPPORTUNITIES AT RAYTHEON

ARMY'S HAWK MISSILE destroys attackers flying at even the lowest altitudes and in the blind zone of conventional radars. Raytheon engineers at the Bedford Laboratory work on this and other vital missile projects.

Advanced work with prime contractor for Army Hawk and Navy Sparrow III

The caliber of Raytheon engineering is an indication of the quality of our staff. Raytheon is the only electronics manufacturer with prime contracts involving complete systems responsibility for both air-to-air and surface-to-air missiles.

As an engineer in our Missile Systems Division, you associate with men of top national reputation in stimulating small groups. Our expanding development has created interesting openings in:

ELECTRONICS PACKAGING
CONTROL SYSTEMS
HYDRAULICS
SPECIFICATIONS

Send brief outline of experience and educational background to G. P. O'Neil, Raytheon Missile Systems Division, Bedford, Mass.

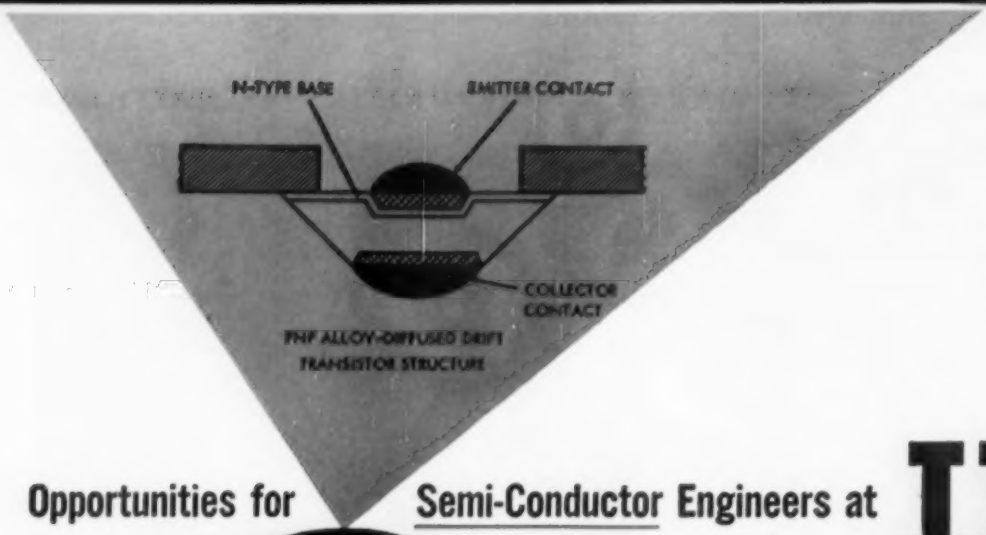
RAYTHEON MANUFACTURING COMPANY
Bedford, Massachusetts

Are you the ONE MAN IN THREE?

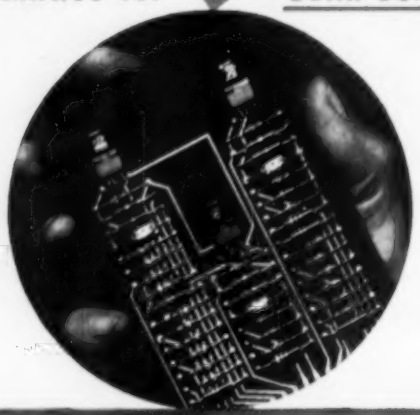
RAYTHEON

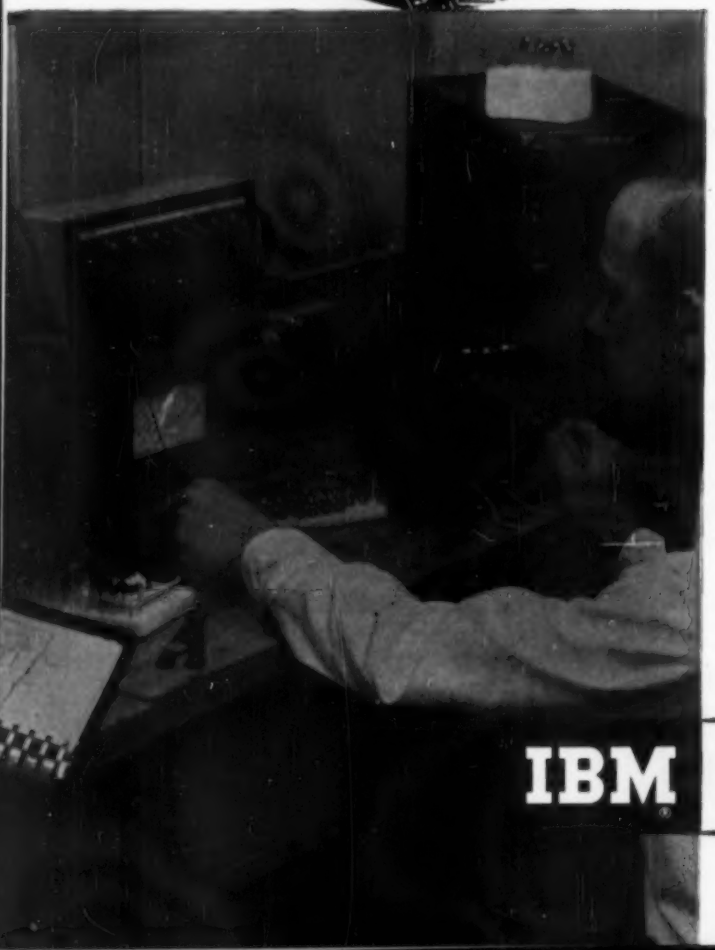
Excellence in Electronics

MISSILE SYSTEMS DIVISION



Opportunities for Semi-Conductor Engineers at IBM





Would you like to play a major role in the design, development, manufacture and application of transistors?

IBM now has challenging assignments in the product development and application of semi-conductor devices for commercial data processing equipment. There are unlimited opportunities for professional achievement and advancement in our Laboratories at Endicott and Poughkeepsie, New York, and at our Manufacturing Facilities at Poughkeepsie, New York.

Qualifications

Advanced degree in electrical, mechanical or chemical engineering, physics, metallurgy or chemistry, *and*

At least 2 years' experience in the design, development, manufacture or application of semi-conductor devices and materials.

Additional career opportunities are available in the following fields:

- **Numerical analysis and programming**
- **Memory devices**

For details, just write, outlining background and interests, to:

Mr. R. A. Whitehorne, Dept. 524L
Mgr. of Technical Recruitment
International Business Machines Corp.
590 Madison Ave., New York 22, N. Y.

IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

DATA PROCESSING
ELECTRIC TYPEWRITERS
MILITARY PRODUCTS
SPECIAL ENGINEERING PRODUCTS
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TIME EQUIPMENT

Plants and laboratories: Endicott, Kingston, Owego, Poughkeepsie, Yorktown, N. Y.; Lexington, Ky.; Rochester, Minn.; San Jose, Calif.

To EMPLOYERS who advertise for MEN:

When there are many applicants for a single position it frequently happens that the only letters acknowledged are those of the most promising candidates. Others may not receive any indication that their letters have even been received by a prospective employer much less given consideration. These men often become discouraged, will not respond to future advertisements, and sometimes question their bona fide character.

Every advertisement printed in the Employment Opportunities Section is duly authorized.

It will help to keep our readers interested in this advertising if you will acknowledge every application received, even if you merely return the letters of unsuccessful applicants with, "Position filled thank you" written or stamped on them.

We suggest this in a spirit of cooperation between employers and the men replying to Employment advertisements.

Classified Advertising Division

McGraw-Hill Publishing Co., Inc.

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant | **Civil Service Opportunities** | **Employment Agencies**
Positions Wanted | **Selling Opportunities Wanted** | **Employment Services**
Part Time Work | **Selling Opportunities Offered** | **Labor Bureaus**

DISPLAYED ——**RATES**—— **UNDISPLAYED**

The advertising rate is $37.40 per inch for all advertising appearing on other than a contract basis. Frequency rates quoted on request.

An Advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Position Wanted Ads are ½ of above rate.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. of AVIATION WEEK, P. O. Box 12, N. Y. 36, N. Y.

WANTED

ADVERTISING MANAGER WITH ENGINEERING BACKGROUND

Requirements: Engineering Degree preferably E.E. Background in electronics or aviation field would be valuable. Experienced in preparation of technical literature, advertising and public relations.

Career opportunity available with Motorola's rapidly expanding military electronic division. Live in Phoenix . . . "Valley of The Sun" vacationland.

Write or phone in confidence to

Robert W. Barton
Marketing Manager

MOTOROLA, INC.
WESTERN MILITARY ELECTRONICS CENTER
8201 East McDowell Road
Phoenix, Arizona
WHitney 5-4311

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

SELLING OPPORTUNITY OFFERED

Sales representative wanted to represent a reliable sub-contract vendor that can produce electrical and mechanical assemblies prototype and production on commission basis. Sabre Electronics, 8000 W. 47th Street, Lyons, Illinois. Phone BIshop 2-2996 or Lyons 3-0104.

POSITIONS WANTED

ATR Pilot 12,000 hrs. Rated DC4. Some 1049H experience. Desire Airline or Exec. flying or counseling to Business or Insurance Company. Age 46—References. PW-6604, Aviation Week.

Airline Transport Pilot available 1 Jan. 58. 4 yrs Corp Chief Pilot. 9600 hrs. Exp. includes 4 E thru light twins. Age 35, Married —Desire position as Corp Capt. or Chief Pilot. Excellent References. PW-6695, Aviation Week.

Miss Jerrie Cobb, 26, holder of multi-engine world's distance and altitude class records, is available for temporary or permanent flying assignments. 5100 hours, fully qualified all types, including DC-3, B-17, experienced international flying. 2 Janssen Place, Kansas City, Mo.

Pilot-ATR-DC3 type rating. Also qualified Twin Beech, DeHavilland Dove, Twin Bonanza, Apache. 4000 hours, 3000 multi-engine. Age 33. Currently Chief Pilot for small company. Eight years public relations experience. Prefer East Coast. PW-6762, Aviation Week.

DON'T FORGET

the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

ENGINEERS, METALLURGISTS

NEW MISSILE DIVISION

. . . of well established Southwest manufacturing company is looking to fill the following positions with well qualified, experienced men. This 2½ million dollar facility will be prime producer of hardware for production missiles.

Industrial Engineer (Methods and Time Study)

Estimate production times, make production routings, including selection of machine tools, types of fixtures, etc. Set up standards for cost control, analyze methods for improvement, apply statistical controls. Thorough knowledge of machining and machine tools. Aircraft experience preferred.

Plant Engineer

Have full responsibility for new facility including heat treat furnaces, air compressors, power load center, air conditioning, and machine tools. Establish preventive maintenance program, lubrication schedule and records. Miscellaneous engineering of machine foundations, storage racks, material handling, chip and waste disposal. Establish complete plant engineering file of specifications, manuals, and prints.

Assistant Superintendent (Heat Treat and Welding)

Have full responsibility for heat treat, plating, and welding operations, and maintenance of metallurgical quality. Assist in installation of new facilities, building and training of his departments.

Direct replies with resume to

CAMERON IRON WORKS
P. O. Box 1212, Houston 1, Texas,
Attention: K. O'Connor.
State Salary Requirements.

TOP EXECUTIVE SALESMAN for BUSINESS AIRCRAFT

Earning potential and opportunity unlimited in growing field with leading distributor of world's best business aircraft. Unit sales to aircraft owners, individuals and companies vary from $10,000 to $100,000. We need a mature, self-starting, successful salesman, used to a five figure income; a relatively young man accustomed to dealing with successful people, top executives. Pilot experience preferable. Company is solid, growing and offers exceptional company benefits. Location in N. Middle Atlantic.

Tell us on seeing you.

P-6734, Aviation Week
Class. Adv Div., P.O. Box 12, N.Y. 36, N.Y.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

DISPLAYED RATES

The advertising rate is $24.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

Closing date is 11 days before issue date, subject to space limitations.

UNDISPLAYED

$2.10 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads.

Send new ads to Classified Advertising Div., Aviation Week, P. O. Box 12, New York 36, N. Y.

FOR SALE

SCHEDULED AIRLINE INVENTORY
of
DC-4 and C-46F Material
consisting of
Airframe, Engine, Radio and Instrument Parts
Ground Handling Equipment
Zero Time on Following Engine Models
R-2000-7M2 R-2800-51 R-2800-75 R-2800-75M2
also R-2800-CB-16-17

THE FLYING TIGER LINE INC.
Lockheed, Air Terminal
Burbank, Calif.
Att: Douglas S. Duty
Mgr. Aircraft Material Sales

Tel. Stanley 7-3411 Cable: Flytiger

Immediate Delivery

We stock, overhaul, and install

PRATT & WHITNEY R1830 –75, –92, –94
WRIGHT R1820 –202, –56, –72
R985 R1340 R2000
and our most popular DC3 engine
R1830 - SUPER - 92

ENGINE WORKS INC.

Lambert Field Inc. St. Louis, Mo.

COMPLETE SERVICES for BUSINESS AIRCRAFT

- Beechcraft sales & service
- Rental & Leasing
- Complete line radio & electronics

30th YEAR Atlantic Aviation CORPORATION

- Used aircraft sales
- Complete maintenance Cubs to DC-3's
- Parts, including DC-3, Lodestar, etc.

FROM MAINE TO VIRGINIA . . . A SHORT HOP TO ATLANTIC

Logan Airport	New Castle County	Teterboro	Philadelphia	Preston Glenn
Boston, Mass.	Airport, Del.	Airport, N. J.	Int'nl. Airport	Airport, Va.
Logan 7-8700	East 8-6611	Atlas 8-1740	Saratoga 6-7500	Lynchburg 3-3134

Deal Directly with Owner

Consolidated PBY-5A

Several immediately available from inventory. Will modify to suit your requirements.

Low engine and airframe hours. Excellent aircraft for passenger, cargo and agricultural uses.

L. J. Ming Wabash 5-3000

TRADE-AYER COMPANY
Linden Airport, Linden, N. J.

ACES

OVERHAUL • EXCHANGE • LEASE
ALL P&W ENGINE MODEL'S

R985 - 1340 - 1830 - 2000
R2800 M1 & M2
R2800 C Series

IMMEDIATE DELIVERY

The original M1 & M2 as engineered by ACES copied by many but never duplicated by any. CAA approved repair station—powerplant class 2

Write, Phone or Cable Today
Sales Manager

AIR CARRIER ENGINE SERVICE, INC.
P. O. Box 236, Miami 48, Fla.
Tuxedo 7-2666

SALE OR LEASE

ROYAL GULL AMPHIBIAN
EXECUTIVE de HAVILLAND DOVE
EXECUTIVE LOCKHEED LODESTAR
GRUMMAN SUPER WIDGEON

TIMMINS AVIATION LIMITED
Montreal Airport
TAL

Your Inquiries to Advertisers Will Have Special Value . . .

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

FINEST AIRCRAFT MAINTENANCE

Twin Beech • DC-3 • Lodestar

CAA Approved Repair Station # 3064
Class 1 & 3 No Limitations

Page AIRWAYS INC.
ROCHESTER AIRPORT
PHONE GENESEE 8-7201
ROCHESTER 11, N.Y.

RADAR

AUTOMATIC PILOTS, NAVIGATION & COMMUNICATION SYSTEMS

Collins, Bendix, Sperry, Lear, ARC

FOR SALE

C-46F AIRCRAFT

Passenger and Cargo

With or Without
T-Category Kit Installed

DC-6C AIRCRAFT

Passenger/Cargo

Immediate Delivery

The Flying Tiger Line Inc.

Burbank, Calif.

Call or Cable

Fred Benninger
Executive Vice President
Tel: Stanley 7-3411
Cable: Flytiger

INVITATION TO BID

DC-3 AIRCRAFT

We will accept bids on five DC-3s operated until recently by Trans Canada Airlines. Aircraft are in excellent condition and fully equipped. Bids accepted until December 15. Foreign currencies considered.

Write, wire or phone for bid forms.

LUND AVIATION (CANADA) LTD.
MONTREAL AIRPORT, P. Q.
MElrose 1-3519

C-47'S FOR SALE DC-3'S
ALSO
REPAIR OVERHAUL MODIFICATION
VOLITAN AVIATION INC.
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EL SEGUNDO, CALIFORNIA

Come Visit our new hangar

Pompano Beach, Florida

airport—by Hillsboro Lighthouse

NO LANDING FEE — NO TRAFFIC

—furnishing full maintenance, conversion, inspection and overhauls for private business operated DC3-C47, Lodestar, and D18S, with complete installation and service of radar, radio, autopilots, electronics, etc. 24 hour line service, Shell 80, 91 and 100 octane gasoline. Extensive recreational facilities on and next to airport—swimming, fishing, golfing, boating, restaurant, showers, etc.

Executive Aircraft for Immediate Delivery

See them at Pompano Beach

Deluxe Super 92 DC-3

New ship guarantee on airframe, 800-hour guarantee on engines. Completely disassembled and rebuilt. Luxurious interior, with all large cabin and picture windows. Lightweight landing gear doors, Collins and Bendix executive radio many extras. Today's fastest and quietest DC-3, 210 miles per hour.

Aero Commander

Trade in on DC3. Excellent condition. Your choice of radio complement—Sperry, Collins, etc.

C18 Beechcraft

Trade in on Custom 18. Choice of hydromatic or constant props, choice of excellent Sperry and Collins radio.

Custom 18

New ship guarantee on freshly overhauled airframe, 800-hour guarantee on engines. Painted exterior, de-icers, radome, large cabin windows, enlarged interior, modified front bulkhead, lavatory, snack bar, special seats. Dual instrumentation, autopilot, Sperry H5 horizon and C2 gyrosyn compass, Collins 51R omni with 51V glide scope, isolation amplifier, dual speakers, many extras.

Grumman Goose

Freshly overhauled airframe, props, and engines (with crankshaft modification), new interior, new exterior paint. Light weight, late model. Omni, VHF, ADF, etc.

Also — to your own order

Super 92 DC-3

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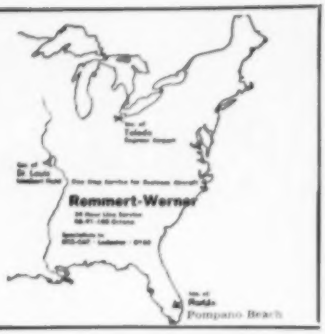

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LETTERS

Moon Photo Theory

The moon's portrait taken by the ROTI Mk. II camera (AW Oct. 28, cover) has been the subject of considerable discussion in our office, at least, and in letters to your magazine. Aside from the technical quality of the photograph, a strange phenomenon has been generally noticed: the craters often appear as mounds instead of depressions, and often snap or "oil-can" back and forth from one shape to the other. This effect is partly subjective (for example, I see craters only about 25% of the time, my wife about 75%; but it is also a result of the simple facts of the case.

One of your correspondents (Nov. 18, p. 158) suggests that the effect is due to the fact that since the picture is monochrome and thus registered only in lights and shadows, inverting the picture will cause the reversal of concavity and convexity. This explanation seems to be inadequate for two reasons: (1) in either the inverted or normal position of this picture, the viewer may see either mounds or craters; (2) any black and white picture would show a reversal of convexity or concavity upon inversion, a phenomenon which everyone knows is not so.

The phenomenon observed in this picture is a result of the fact that the angle subtended by the object, as photographed, was so small that all rays of light coming from the object to the camera were essentially parallel. As we look at the photograph, our line of sight strikes each part of the picture with a unique angle, and our eye expects to see a difference in detail because of this difference in aspect. But it does not, since each part of the picture appears as it would if the eye were directly over that part. Thus, the attainment of depth perception due to angular coverage is completely lost, and the sloping sides of a crater appear no different than they would if they were sides of a mound (lighted from the opposite direction).

In direct contrast to this photograph is wide angle photography, which can attain a very high three-dimensional effect through only one lens.

Waldo M. Claflin
Preliminary Design Dept.
Grumman Aircraft Engineering Corp.
Bethpage, N. Y.

Mil-4 'Turkey'

Re the Nov. 11 issue of Aviation Week (p. 65), perhaps we, too, should join in extolling the virtues of the Mil-4 helicopter. To know that such a turkey can exist in this day and age should gladden the heart of anyone with hypertension resulting from recent disclosures of Soviet advances in the technological race.

Designer M. L. Mil used originality only in adapting the size of the Sikorsky S-55 helicopter to a large powerplant and adding an extra main and tail rotor blade. He must have been handicapped by lack of know-how as to the construction of main rotor blades, since the type shown was in production on Sikorsky R-4 models in 1944. This

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

type of construction today would result in a helicopter cost of operation which would insure fertile seeds of rebellion in the undernourished directors of collectives. The overall result shows the Mil-4 to have a per cent of useful load in terms of gross weight of 28%, whereas corresponding figures for the S-55C, H-19D, and S-58 Sikorsky models are 31.3, 34, and 40%. Such figures obviously indicate a lack of finesse employed in aircraft design and/or non-availability of proper raw materials.

The Soviet comparison is unfairly taken in relation to aircraft size. A more reasonable comparison would have been the S-58 type helicopter (now five years old) that has approximately a 1,000 lb. greater useful load, yet is 3,000 lb. lighter than the Mil-4. This obviously shows that development of a new type helicopter is often preferable to enlarging an older configuration.

Also, Mr. M. L. Mil obviously didn't read Associated Press clippings, or the claim of a world speed record of 116.4 mph. would not have been listed. The Sikorsky YH-39 established a world's record of 156 mph. in 1954.

In review, Soviet propagandists look pretty silly in this instance. Also, American public is entitled to more accurate, factual reporting which could utilize existing data to combat nonsense like this, rather than allowing it to be unchallenged when printed. It would almost seem a sympathetic presentation.

H. R. Thurber
Norwalk, Conn.

Action Proponent

One of the most interesting points in your article on the Avro CF-105 Arrow (AW Oct. 21, p. 50) was that it was rolled out on the same day Sputnik was launched. This makes Oct. 4, 1957, doubly significant as the day the Eisenhower-Madison Ave. defense program got "all shook up."

It is interesting to note that the CF-105 arrow is similar to the Delta Scorpion long range interceptor that Northrop Aircraft, Inc., had on its drawing boards in 1953. The Delta Scorpion met a typical Defense Department paper shuffling routine. First they "ran it up the pole to see who would salute." Then they "put it out on the stoop and let the cats lap it up." After this a design specification was prepared and three design competitions were held. Finally four years later a design study contract was awarded to North American Aviation, Inc., for the YF-108. In this same period the Canadians got their supersonic long range interceptor, the CF-105, ready for production and I'm sure the Russians did, too, in addition to Sputnik and their ICBM.

In the March 25 issue of Aviation Week, p. 23, it was reported that "Lockheed's Military Operations Research Division is pushing a new defense concept centered around a large aircraft carrying both warning radar and batteries of interceptor missiles of the Boeing Bomarc class." This defense concept is a good idea. But right now the Madison Ave. weapon system engineers are "throwing it down the well to see if it makes a splash." If there's a splash, they'll send it through MR (motivation research) and give it "personality." This will put dither into the id servos of the subconscious mind of the Defense Department and someone will get a contract. Who will get the contract will be based upon an economic analysis of what section of the country and what company needs the business provided the company is qualified to do the job. All this Madison Ave. weapon system analysis will require about three years. By then the Russians and maybe the Canadians, too, will have something similar ready for production.

I certainly hope the Canadian government will ask the RCAF to try and capture the official speed record for the world's fastest combat airplane with the Avro CF-105 Arrow.

LeRoy F. Iverson
Manhattan Beach, Calif.

Political Frustration

In AW Oct. 28 (p. 30) one, Senator Capehart, in obvious frustration over Sputnik, made the contradictory statement that "the inventor of the radio, which was more startling than Sputnik, was Marconi, an Italian, but, of course, history proves that we were the ones to develop it and get the most use and good from it."

Please ask the Honorable (Senator) what is sending the "Beep-Beep" from a point hitherto unheard of in the realm of radio?

Robert Hotz's excellent article in AW (Oct. 28) "Intelligence Without Leadership" is a stark tribute to just such political frustration as the type of legislators we have in the Capeharts and others are displaying. It is a pity AW does not meet more of the general public instead of just we in the industry.

W. C. Heller
Flourtown, Pa.

Business Flyer Pleased

As an owner of a consecutive series of new single engine business airplanes, and a prospect for a Comanche, I was extremely pleased to see your cover and read your "check flight" (AW Nov. 11, p. 100). The completeness of the report answered all the questions I've had in mind about Piper's new model. More than that, your recognition of the stature reached by modern single engine business airplanes is gratifying to someone familiar with their safety and utility. Please continue to recognize a growing portion of the readers of your business flying section are in little business rather than in big business.

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